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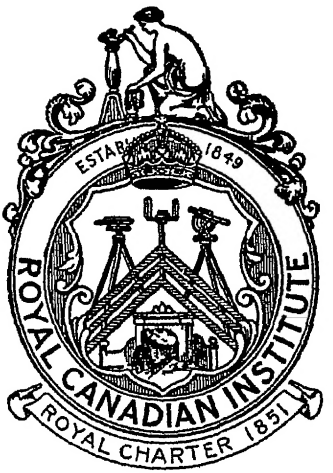

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CONTENTS

TRANSACTIONS
OF
THE CANADIAN INSTITUTE

IMMIGRATION.

By Gilbert E. Jackson, B.A.

(*Read 16th November, 1912.*)

The Canadian Institute of Toronto is naturally more interested in the Canadian problem than in the subject of immigration as a whole. That problem may be approached from more than one standpoint. The railway magnate or investor is more concerned with the volume and future volume of incoming foreigners than with considerations as to their quality and the forces which attract immigrants of different kinds. The statesman, on the other hand, and not only the statesman, but the private citizen, is more concerned to know the composition of our vast mass of immigrants than its volume and the causes at work which regulate the proportion of Greeks and Russians, English and Italians, Jews and Hungarians and Poles to one another. He is aware that it is this which will determine the future nationality of Canada; he is interested to know whether Slav or Latin or Anglo-Saxon will dominate the rest; and (since he probably holds certain very definite ideas as to what should be the Canadian nationality) he wishes to find out if any of his actions will help or hinder the attainment of his ideal. It is an accepted principle in the United States that no discrimination on the score of race can be practised against European nations; and what a people of ninety millions cannot afford to do, is still more impossible for us. But there must be certain things in Canada which attract or repel certain races; and it is easily possible for us so to arrange these as not to discourage those immigrants whom we desire, and not to bring in a larger number than would otherwise come of the peoples whom we do not want. It will be the task of future students of immigration to study those forces and the means of bringing them beneath control.

The idea which forms the subject of the present paper, occurred to the writer in the spring of 1912, when after reading little and seeing much of the street life of Toronto, he was in a position at any rate to tell the outlines of the problem. To the newcomer the outstanding feature about immigrant life in Toronto is its segregation.* A very short

*"We have to-day our little Italys, little Russias, little Syrias, and so on, in our midst, vortex-rings of nationality, closed to the outside medium in which they live, though possibly shifting en masse from one place to another as the currents of economic demand bear them. Such results were not known with the earlier British, German and Scandinavian populations."—Prescott F. Hall, "Immigration and its Effects upon the United States", Part II., ch. viii., pp. 177, 178.

acquaintance with the foreign districts enables one to distinguish a specifically Jewish area; another mainly but not entirely Italian; a third largely Russian; a fourth Macedonian; and a fifth considerably peopled by Chinese. It is these that give the lie to the statement that there are no slums in Toronto. Their most marked feature is this: that they stand apart from the native Canadian life, and to some extent apart from one another. Probably about one-fifth of the population of this city is of alien blood; and it is not assimilating with the rest, or, if assimilation does occur, it goes on very slowly. Toronto does not appear more cosmopolitan than many an English seaport; but here it has a problem such as none of the seaports of England has had to face.

Such a picture as Ward 4 presents suggests two questions. Are these people attracted only by city life, and does the country make no appeal to them? And again, if they were scattered in the country, would they assimilate with us more easily than they do at present in Ward 4? The answer to the second question * is complicated by the fact that the railways may by their choice of policy produce quite unforeseen results. The Canadian Pacific Railway seems as a rule to have settled foreign immigrants in groups together, so as to make whole areas alike, Finnish or Scandinavian, Russian or Icelandic. Whatever would otherwise have happened, it is therefore quite certain that under present conditions the countryside can have no special powers of assimilation. The answer to the first question is less easy. The cities of Canada have grown phenomenally, and into them have flowed foreign immigrants by the hundred thousand. If, instead of this, the cities had remained comparatively small, and Canada mainly an agricultural country, these people might or might not have thought it worth their while to come. To decide this question we must have recourse to the Census. If under present conditions we find the percentage of certain races in the towns markedly different from the percentage of the same race in the country, then may we not legitimately conclude that one or other exercises a superior attraction, and that on the predominance of town over country, or *vice versa*, depends to some extent the continued immigration of these races?

In this connection the Canadian Census is of very little use. Canadians do not need to be reminded that this is a very immature country. Its youth is at the same time a source of pride in and fear for its future.

* "One must emphasise the difference between immigrants settling in large cities or in mining regions, and those who are scattered out into smaller cities and in the country districts. In the latter they soon tend to mingle with the other residents, and the children grow up under similar and fairly wholesome conditions. But in such places as New York or Chicago they keep to themselves, often in streets inhabited entirely by those of the same race."—Bryce, "American Commonwealth", Vol. II., p. 478 (edition of 1910).

Any tendencies that are at work in Canada to-day will date from about the year 1896; and sixteen years is a very short period in which to study any change. It is the more difficult, inasmuch as the first volume alone of the 1911 Census has been published, and that volume tells us very little. From it we learn that between 1901 and 1911 the population classified as "urban" increased by 62.33%, while the population classified as "rural" increased by only 17.53%. Since the statistics of population at present available give no hint of the racial composition of these people, we cannot watch the results of this great change. In order to know what is going on in Canada, we must study the same tendencies in some other country, whose statistical records are less absurdly inadequate than those of the Dominion, and attempt by comparison of our similarities and differences to estimate what is going on in our own midst.

At this point the student of immigration naturally turns to the United States. Not only has the Census Bureau at Washington provided the most elaborate statistical tables to be found in the world, but also those tables relate to conditions very like our own. A part of the North American Continent, approximately equal in area to Canada, subject largely to the same climatic conditions, developed by men of the same race as our own, growing, as we do, the foodstuffs of the world, and, like ourselves, boasting of the worst and the best features of democratic government, presents a good many points of similarity with our country. Wages and opportunities of investment and the cost of living, the scale of life in the cities and other differences there may be, but these unlikenesses are of a less magnitude than the likenesses already mentioned. So if certain forces, now at work in the United States, can be seen to produce certain definite results, it is probable, in view of the points of resemblance between the two countries, that if those forces are at work in Canada, they are producing these results here also.

The development of our own country dates, for present purposes, from about 1896. In that year the comparative stagnation of several decades seems suddenly to have ended. For many reasons—mainly, no doubt, because of the rise in the price of wheat after 1894—continuous streams of capital and labour have been pouring into Canada; and the native Canadian has prospered. The corresponding period in the United States appears to have begun some thirty years earlier. The end of the Civil War, the formation of the joint-stock corporation, the use of the steel rail, and of the triple expansion engine—these things together transformed the continent. We may study American tendencies in immigration as a whole, from the census of 1870 to that of 1910: and just as the present large scale immigration into Canada began only

after some years of great commercial activity, so it is roughly not from 1870, but from 1880 that the present great invasion of these shores may be dated by Americans.

IMMIGRATION INTO U. S. IN DECENNIAL PERIODS.

Period of Years.	Number of Immigrants.
1871-1880	2,812,891.
1881-1890	5,246,613.
1891-1900	3,687,564.
1901-1910	8,500,000.*

During those years the government of the United States pursued a policy of high protection. This was partly forced on them by the need of revenue after the war: in part it was a deliberate attempt to build up the cities and urban industries. If we take as our unit of city life that which has 25,000 inhabitants, we find a curious parallel with the statistics of immigration.

U. S. A. PERCENTAGE RATIO OF URBAN TO TOTAL POPULATION.

In 1870, 15% of the population lived in cities of 25,000 and more inhabitants.

In 1880, 19.8% of the population lived in cities of 25,000 and more inhabitants.

In 1890, 23.6% of the population lived in cities of 25,000 and more inhabitants.

In 1900, 25.9% of the population lived in cities of 25,000 and more inhabitants.

In 1910, 31.1% of the population lived in cities of 25,000 and more inhabitants.

How far this was due to the tariff, and how far to natural causes, we do not know. It is one of the counts against Economic Science, that while it claims that it produces results, it seldom or never produces quantitative results. So in this case. The growth of agriculture in the Middle West and West and in the South must in any event have led to the growth of cities for the supply of the farmer's immediate wants and for his amusement; just as Edmonton and Calgary, Saskatoon and Regina have sprung up on our prairies, in spite of Eastern competition. How fast they would have grown we do not know, and so we cannot speculate on the debt owed by the modern cities of America to the pro-

*Since the census of 1900 was taken as of June 1st, and that of 1910 as of April 15th, this last figure can only be given as an estimate.

tective tariff.* All that we can say is that in the last generation the Republican Party to some extent attained its object by Protection, though part of its success was due to other things.

It must be remembered in this connection that, in so far as the growth of cities in America has been caused by the tariff, these cities are not a net addition to the national life, but a substitution of one thing for another. During the period of its action, a tariff cannot increase the total income of a nation. If it directs that nation's energies into urban industry, it is at the expense of rural life. Where the tariff has increased the urban population, it has checked the growth of the rural population of the United States by at least a like amount.

It is therefore undeniable that the tariff has had an effect on immigration, and so on the racial composition of the American people. It has acted as a lure to those Europeans who have a preference for city life, and as a deterrent to those Europeans who have a preference for country life. What have been the changes in the racial composition of the twenty millions of people who have entered the country between 1870 and the present time?

The figures given below are an attempt to answer this question. They are compiled from the statistics of the Commissioner for Immigration, and do not include the total immigration of the period, as may readily be seen by comparison with the table of immigration given above. In this table the various peoples have been classed according to differences of race and outlook, Latins and Slavs being lumped together in Group iii for reasons which will be discussed.

Group i. includes the people of the British Isles.

Group ii. includes Danes, Norwegians, Swedes, Dutch and Germans.

Group iii. includes the people of Russia, Italy, Austria, Hungary, and the Spanish and Balkan Peninsulas.

IMMIGRATION INTO U. S. A., 1871-1910.

	1871-1880	1881-1890	1891-1900	1901-1910
Group i.....	985,000	1,463,000	746,000	865,000
Group ii.....	978,000	2,163,000	954,000	895,000
Group iii.....	191,000	933,000	1,910,000	5,919,000
Total.....	2,154,000	4,559,000	3,610,000	7,679,000

*It is suggested to me by Professor G. I. H. Lloyd that in view of the rapid growth of cities in Argentina and other low-tariff South American countries, it is unwise to lay much stress on the influence of Protection in this case. It is of course as difficult to advance as to refute an economic theory of causation such as this; but it may be remarked that the great growth of Buenos Ayres occurred, not in the low-tariff days of Argentina, but after her adoption of a high tariff late in the nineteenth century. Buenos Ayres, like Rio de Janeiro, Cape Town, Melbourne and Sydney, is at the same time a great seaport and the seat of manufacture. Free-trade assists her to develop in her first capacity; Protection in her second. It is not strange that all new countries, whatever their tariffs, have at least one large seaport; but I do not know of any low-tariff country comparable in size and development with the United States or Canada that has an

PERCENTAGE RATIOS OF THE THREE GROUPS.

	1871-80	1881-1890	1891-1900	1901-1910
Group i.....	45.7	32.1	20.8	11.1
Group ii.....	45.4	47.4	26.4	11.7
Group iii.....	8.9	20.5	52.8	77.2
	100.0	100.0	100.0	100.0

From these tables it will be seen that in the last two decades the movement of Anglo-Saxons and Teutons has increased absolutely, but declined in relative importance: while that of the peoples of Southern and Eastern Europe has increased more than thirty-fold, so that at present these immigrants outnumber those of Northern and Western Europe in the proportion of between three and four to one. Such a change cannot entirely be explained with reference to the internal development of the United States: we must look to general causes. Nevertheless, when all the weight to which they are entitled has been given these general causes, there will remain something to be said as to the contemporary change in American society.

First of these general causes is the rise in the cost of living. The same discontent, provoked by the slow adjustment of wages, has caused in England the late labour disputes and the recent flood of emigration. The fact that this has not been reflected in the American figures may be attributed to the rise of Canada, with its free homesteads, which attract an increasing proportion of the British-born. Wages in Germany have changed more swiftly to meet the cost of living, and so the absolute increase in British immigration into the United States is accompanied by a slight falling off in the movement of Teutons and Scandinavians. The slight increase in the combined figures during the last decade is, however, far surpassed by the tremendous increase among those included in Group iii. This increase is susceptible of three partial explanations.

In the first place, incomes in Southern and Eastern Europe have always been lower than in England and the German Empire. Until a certain level is reached, the people cannot migrate; and in one sense, the history of Europe in the last century may be read in the four waves of emigration, British, Teutonic, Latin and Slavonic, which succeeded one another at intervals of about a generation. Moreover, while at one time the local authorities in England and Ireland were doing their utmost to help the poor to become a charge on the Associated Charities of New York, the Italian, Austrian and Russian governments were making it very difficult for their own people to cross the Atlantic. Now that this state of affairs no longer obtains, the removal of these obstructions to emigration makes the outburst particularly striking.

Secondly, the influence of the steamship companies and padroni must not be left out of account. For years together, during the period under review, the number of agents making a profit on the people they transmitted to the great contractors, must have numbered between ten and twenty thousand, most of whom worked among the southern and eastern peoples.

Thirdly, the fact that from 10% to 50%* of these immigrants have their passages paid by friends and relatives in the United States must be considered. It is probable that the proportion of assisted passages among immigrants in Group iii. is higher than that in Groups i. and ii. Moreover, this is a cumulative tendency. The larger the number of Latins, Jews and Slavs on this side of the Atlantic, the larger the number of Latins, Jews and Slavs whom they will bring; the larger the number of Latins, Jews and Slavs who come to these shores, the larger the number of those who are paying the steamship companies to bring out their friends and relatives; and so the process continues.

These three forces together account in large measure for the recent change in the character of immigration to this continent. Even if there had been no change in the social and industrial structure of the United States, something of the sort would have occurred. In point of fact, as has been indicated, city life began to assume more and more importance in American life, at the beginning of the period, and becomes still more important every year. The influence of this, on the feelings of Europeans with regard to the New World, may be shown in the following table. Incomplete as it is, it is instructive.

U. S. A. CENSUS REPORTS OF 1890 AND 1900.†

Percentage of foreign-born population living in American cities of 25,000 and more inhabitants.

Of those born in						
Norway, in 1890,	20.8%,	and in	1900,	22.4%	lived	in such cities.
Denmark "	23.2%	"		28.1%	"	"
Wales "	25.8%	"		32.3%	"	"
Sweden "	31.8%	"		36.3%	"	"
Holland "	33.5%	"		44.1%	"	"
Scotland "	41.3%	"		46.0%	"	"
England "	40.7%	"		46.3%	"	"
Germany "	47.7%	"		50.2%	"	"
Hungary "	44.8%	"		53.4%	"	"

*Report of the Industrial Commission, Vol. XV., pp. 95 et seq., on assisted immigration.

†Statistics of 1910 are not available, excepting detailed statements with regard to particular cities.

Austria in	1890,	48.3%,	and in	1900,	53.5%	lived in such cities.
Bohemia	"	48.3%	"	54.3%	"	"
Ireland	"	56.0%	"	62.0%	"	"
Italy	"	58.8%	"	62.4%	"	"
Poland	"	57.1%	"	62.6%	"	"
Russia	"	57.9%	"	74.9%	"	"

Thus, of the Danes, Norwegians, Swedes, and Welsh, more than two-thirds may be reckoned as dwellers in the country and the smaller towns. Of the Dutch, the Germans, the Scots and English, more than half avoid the cities. All the rest, in increasing degree, are city-dwellers; and of the Russians, very many of whom, as is noted elsewhere, are really Jews, three out of every four live in cities of 25,000 inhabitants and upwards.

From this it will at once be seen that, while the drift of all races to the cities is increasing, the peoples of Northern and Western Europe are still, broadly speaking, lovers of the country, while the peoples of Southern and Eastern Europe gravitate to the towns. This is the more curious, since in Europe the proportion of the population which lives in large cities is higher in the north and west than in the south and east. Nevertheless, the facts must be admitted; with this also, that in course of time the difference between the two groups of people grows more marked. Germany, for instance, in 1890, surpasses Hungary, and resembles Austria and Bohemia in the number of her people living in the cities; but now she has definitely crossed over to what may be called the western side, and stands half-way between England and the nearest eastern country; while the difference between the Russian and the German figures is immense.

It is curious to notice that Ireland alone of the western countries stands with the peoples of Italy and Poland, as also she did at the previous census. This may give us the clue to one explanation of these figures. It may be remarked in passing that, compared with the Scots, English, or German immigrants, the Irishman in America appears to be lacking in initiative, as well as in stamina.* The close resemblance of the figures for Ireland and Italy suggest, however, an explanation based on temperament. Dwelling far apart, as they do, both are Keltic peoples. Both love colour, lights, companionship and excitement. Neither has any aptitude for the solitary labours of the pioneer, or even the lonely work of the farmer. The point was well brought out in an unpublished lecture, delivered by Mr. L. Smith-Gordon in the University of Toronto this November. In discussing this same question he was able to describe

*Hall, "Immigration and its Effects upon the United States", Part I., chapter iii., p. 53.

from personal observation, the attitude towards America of emigrant Irishmen who had returned. To them all, men who had earned their livelihood in New York and Boston and Chicago, the great attraction of the United States lay in "the city, with the lights and the people".

Be that as it may, for one reason or another the rustic Kelts and Slavs* of Europe flock to the cities of America. The regularity of their movement may well be observed in the following table:

DEVELOPMENT OF U. S. A., 1870-1900.

	1870-1880	1880-1890	1890-1900
A. Increase per cent. in the number of all wage-earners employed in manufactures	33.1%	55.6%	24.8%
B. Increase per cent. in the number of the foreign-born population (included in Group iii.)	138.7%	207.9%	129.3%
Ratio of B : A	4.19 : 1	3.74 : 1	5.21 : 1
Average ratio		4.38 : 1	
Variation from the average	−.19	−.64	+.73

The close correspondence of these two sets of figures is indeed remarkable; probably this would be closer still if civic employees and retail trades could be grouped with the wage-earners employed in manufacture.

We are now almost but not quite able to state definitely that the artificial stimulation of city life by the tariff has discouraged immigration from Northern and Western Europe and encouraged immigration from Italy, Austria and beyond. Here, however, the student of immigration may say that the preference for city life among peoples in Group iii. is more apparent than real; that they come to this continent solely in order to escape from conditions of discomfort in Europe, and that they remain in the cities when they disembark, solely because their poverty compels them to do so. The cities are situated mainly near the Atlantic: the immigrant easily reaches them, but finds it difficult to leave them.

That there is some force in this contention is shown in the following figures, which represent the proportions in which the foreign immigrants from South-east Europe are distributed geographically among the grand divisions into which the Census Bureau groups the States:

*It must not be forgotten that all the southern and eastern countries of Europe contain mixed populations. In 1910, of those residents in the United States who had been born in Austria, 14% were Germans; and their influence doubtless makes the percentage (53.5) in the above table slightly lower than otherwise it would be. Similarly 45% of those registered as born in Hungary were not Slavs, but Magyars. Of those born in Russia, more than 50% were Yiddish and Hebrew.

Percentage of total living in—	1900	1910
1. New England, Middle Atlantic and South Atlantic Divisions	64.2	64.4
2. East North Central, East South Central, West North Central and West South Central Divisions	29.9	28.7
3. Mountain and Pacific Divisions	5.9	6.9
	100.0	100.0

Thus, roughly two-thirds of these immigrants remain in the East; but although the proportion of those in the East shows a slight increase in the last ten years, it can hardly be called a definite tendency, for those in the extreme West show a larger growth in importance. Without more definite knowledge as to the precise position of individuals it is impossible to dogmatise; but from these figures it appears probable that the average distance from the Atlantic seaboard of immigrants in Group iii. is slightly larger than it was. Thus

$$\{64.2+(2\times29.9)+(3\times5.9)\}<\{64.4+(2\times28.7)+(3\times6.9)\}.$$

We are faced with the fact that a large, but stationary percentage of the total remains in the East, and we are asked to believe that this is because they are too poor to go to the Central States or the Coast. According to this argument we do not and cannot know what are the preferences of the people; all that we can see is the economic disadvantage under which they labour. This may roughly be tested by an enquiry into the financial circumstances of various immigrants on landing.

The ten peoples for whom returns are given on the following page have been arranged (reading from left to right) according to their probable average wideness of distribution, as shown by the method of calculation already used. The Scandinavians are probably the most widely distributed of all, the Irish and Italians the most concentrated. It will be seen that the connection between average of money shown and wideness of distribution, if it exists at all, is very hard to trace. The Dutch, with more money per head than the Scandinavians, are probably the less widely distributed; with less money per head than the Germans, they are probably the more widely distributed. There is no possible comparison between the distribution of Irish and Scandinavians; though the Irish have very little less money than they, and more money than the well distributed Croatians. The Greeks, with nearly twice as much money as the Scandinavians, are far less widely distributed; and yet there is a marked difference between the distribution of Greeks and Germans, although both show the same amount on entering the country. The Italians appear to have very little money, and yet the difference

	Scandinavian.	Greek.	Dutch.	Bohemian. Moravian.	German.	Croatian.	Scots.	English.	Irish.	Italian.
Average amount of money shown in 1900*	$16.65	$28.78	$21.00	$23.12	$28.53	$12.51	$41.51	$38.90	$14.50	$11.57 (?)
Distribution of the foreign-born in 1910:										
1. New England and Atlantic Divisions	15.0%	37.7%	21.6%	19.3%	31.6%	40.7%	50.1%	49.0%	66.9%	71.8%
2. North and South Central Divisions	70.1%	35.1%	72.2%	77.3%	62.6%	46.0%	34.9%	35.6%	26.3%	19.8%
3. Mountain and Pacific Divisions	14.9%	27.2%	6.2%	3.4%	5.8%	13.3%	15.0%	15.4%	6.8%	8.4%

* Report of the Industrial Commission, Vol. xv, p. 284. As the year 1900 is obviously inapt for comparison with the first table, since immigrants are distributed slowly, the Thirteenth Census has been used for statistics of distribution.

between their showing and that of the Scandinavians is proportionately, as well as absolutely, far less than the difference between the showing of Scandinavians and Greeks or Germans. There is no very obvious connection between the amount of worldly possessions and the geographical distribution of immigrants among the States.

It must of course be admitted on the other side, first that 1900 may not have been a representative year, and secondly that the average of money shown by immigrants from a particular country may be very different from the normal showing. Mr. Hall* quotes the case of the Hebrews, when on one occasion one man showed $25,000, and nine thousand were practically destitute: the average therefore being about $3.00 for the group. These objections must be given some weight; although, with an average annual immigration of 850,000 persons, it may be that variations in opposite directions tend to correct one another. It may be that there is a break in the poverty line between an average showing of $14.50, and an average of $16.65: that below this figure the immigrant has no power of choice as to residence, while above it he can follow his inclinations. It may be that the Greeks and the Lombard Italians and the Bohemians and Moravians can settle where they please, and that the Neapolitan Italians, Ruthenians, Croatians and Poles settle where they must. But it is difficult to see wherein lies the magic of $15.00. The Croatians, a very poor people, whose average showing falls short of this, are less widely distributed, it is true, than the Bohemians and Moravians, but more widely than the Scots and English, whose average possession is three times greater than theirs.

This point is further borne out by the Thirty-fourth Annual Report of the Bureau of Statistics of Labour† (Massachusetts), which discusses "Race in Industry", using the statistics of occupation for those of foreign descent, as well as of foreign birth. From this report the statistics of labourers have been taken. These, purely local as they are, are of great value. In the limited area of Massachusetts, it is impossible that those persons, whose unfitness for any higher occupation condemns them to be labourers, cannot get away from the cities to the land. Moreover, since all those under consideration are themselves without property, there can be no question (as there may be among independent farmers) of poverty barring men from their occupation. Those races which prefer life in the country will show more than the average proportion of labourers in agriculture. Those which prefer life in the city will show less.

*Hall, "Immigration and its Effects upon the United States", Part I., chapter iv., p. 20.

†Massachusetts, Public Document No. 15, 1904, pp. 1-130.

Proportion borne by the number of labourers employed in agriculture to the total number of labourers in Massachusetts:

Labourers of native descent		63.6%
Labourers of foreign descent (includes only races specified in table)		30.8%
Labourers of Welsh descent		78.7%
Labourers of Swedish descent		40.1%
Labourers of German descent		38.4%
Labourers of Scotch descent		38.2%
Labourers of English descent		37.1%
Average of five races	38.5%	
Labourers of Polish descent		58.0%
Labourers of Portuguese descent		38.1%
Labourers of Russian descent		20.3%
Labourers of Italian descent		3.7%
Average of four races	23.0%	
Labourers of Irish descent		17.9%

In Massachusetts, all the British and Teutonic peoples retain their preference for the country. The Irish again follow the Italians in their love of city-life, though not so closely as in previous tables. The Russians may be grouped with them; and between Russians and English the difference is conspicuous. The only Latin people showing a preference for agriculture are the Portuguese, who form only 2½% of the total number of labourers. The only people from Eastern Europe, whose agricultural proclivities are above the average, are the Poles, who, however, are only half as numerous, all told, as the Portuguese. In spite of these two minor variations, we may fairly say that the rule holds good, the Northern and Eastern races being quite distinct in their love of the country. The Jews appear in this Report to have been included among the people of the country from which they came. The Polish figure suggests that they may have been classified rather clumsily, though in any case the number of Jewish labourers is probably very small.

A further piece of collateral evidence is supplied by the evidence of Mr. Hall before the Industrial Commission.* A question of Representative Livingston, as to whether New York and Boston could not rid themselves of the foreign element if they pleased, elicited the following: "The experiment has been tried in New York by the Hebrew Aid Society in colonising Hebrews. I think $600.00 per family was expended in carrying some families out of New York City. In two years most of them were back again: they will not stay. I think you will find it the same way with the Italians, Armenians, Hungarians, and Slovaks. When I

*Report of the Industrial Commission, Vol. XV., Hearings, p. 56.

ask where the illiterates do go, I find they go to the cities. They go to the slum portion of the cities very largely." No doubt one reason why the Jew will not stay in the country is, that his physique does not fit him for hard manual labour. This was true also of the immigrants from Ireland during and after the "hungry forties". The clothing trade is the special industrial province of the Jew. Here his deft fingers, and perhaps his artistic sense, give him an advantage which is not neutralised by his deficiencies of bone and sinew. The connection between the tariff and the number of foreign-born Jews in the cities is therefore especially direct. Had not the clothing trade been so highly protected, American foodstuffs would have paid for English clothing. The tariff diverted employment from agriculture to the clothing industry, and the Jews seized on this occupation. The chance thus opened to the first comers enabled them to prepay the passages of relatives and friends in great number, who likewise made this their principal occupation, and so the rate of immigration gathered momentum with the flight of time, labour in the clothing industry became too plentiful, and New York began to rival London in the horrors of its sweating system. We cannot now see the end of this development. No doubt the imposition of a minimum wage in the sweatshops, by depriving certain workers of all hope of employment, would bring this class of immigration suddenly to an end; but it is to be hoped that measures may be devised, which will be less cruel to the poorest of all our industrial workers.

Direct and indirect, the influence of Republican Protection is to be seen in the tremendous preponderance of Latin, Slavonic, Jewish and Magyar immigration at the present day. Even now we are not in a position to deny that without the tariff the preponderance would have existed. But, taken together, the Census Reports, the Report of the Massachusetts Bureau of Labour, and the experience of the Hebrew Aid Society drive us irresistibly to the conclusion that owing to that tariff, this preponderance is greater than it need have been.

One further effect of this remains to be mentioned. It is not necessary here to repeat the proof of the late General Francis A. Walker,* that immigration into a young country, by threatening the standard of life of the native population, lessens the birth-rate among these natives, and so leads in the end, not to an addition of foreign people to the total of inhabitants, but to a substitution of these foreigners for the native element which *would have been born* had this immigration not occurred. The statistical work of the late Elkanah Watson, on the probable increase of the American population (which is quoted and discussed by General Walker in "The Forum", Vol. ii.) gives some colour to the supposition

*Walker, "Discussions in Economics and Statistics", Vol. ii., pp. 417-455.

that the effect of immigration is to decrease the native birth-rate by an amount about equal to the number of the immigrants. That this is by no means an absurd overstatement is further shown by R. R. Kucgynski,* who was able so long ago as in 1902 to demonstrate that in Massachusetts the native population is slowly dying out. In other words, restriction of births within the family has already gone so far that the present generation is less numerous than the last. Where the tariff has altered the racial composition of the people, it has therefore, by causing a fall in the native birth-rate, altered the relative proportions of native-born and foreigners by approximately twice what it would at first appear to have done.

It may be that the replacement of native American by Neapolitan, Semitic, Slavonic and Ruthenian stock is altogether for the good of the race as a whole. Perhaps ultimately the introduction of these new peoples, with their artistic taste possibly more developed, their religious and emotional faculties more mature than those of the old race, may produce after fusion, a race still finer and more capable. On the other hand, the fusion may give to each element the worse, without the better qualities of other elements. We do not know. All that we can say is this: that for the next fifty years a hard task lies before our neighbours, the assimilation of some twenty million immigrants. The process does involve, and will involve much suffering. Social corruption and political corruption and a revolutionary labour movement are the three signs of distress, which the blindest of us must observe. Some of these immigrants are more capable of assimilation than others. The only perfect test of these capabilities would be an exhaustive enquiry into the intermarriage of the foreign-born with the native population. This the writer has not at present been able even to begin. A rougher test is the similarity or dissimilarity of various races, compared with the native American. Such a test, making allowance for differences of language, would divide the races, as above they are divided in Groups i., ii. and iii. The Anglo-Saxon, English-speaking peoples would come first; next to them, the Norse and Teutonic peoples of northwest Europe; after them the Latins, Slavs, Magyars, Jews and others, who fall broadly into the third of these three groups.†

Thus, the net effect of the stimulation of American urban industries by the tariff has been to bring in the less assimilable instead of the more assimilable races of Europe, and to restrict the birth-rate among the native population. If the native population had to compete with the

*Quarterly Journal of Economics, Vol. XVI., pp. 1-36, 141 186.

†It is, however, maintained by Mr. J. H. Senner, North American Review, Vol. 162, 1896, that the Italian is easily capable of assimilation.

peoples in Groups i. and ii., the fall in their birth-rate would have resulted in their replacement by people similar in ideas and outlook, similar in blood and tradition and religion, and often the same in language as themselves. As it is, they have, by this artificial means, been replaced to a greater extent than was necessary, by the people least quickly assimilated, differing most widely from them in all their qualities. This has increased the difficulties of every problem that they have to face; and it will not be forgotten by their children's children.

For us, the history of the United States may serve as a stimulus and as a warning. We may never rival their achievements; in the light of their experience we may sometimes avoid their great mistakes. In this case we have more at stake than they. In no single year has the number of immigrants of all nations, entering America, reached so high as 2% of the population of that country at the time. Our proportion at present is nearer 6% than 5%; whatever the United States have experienced in immigration, we shall experience more intensely still. Where they have postponed the formation of a national type and character, we shall postpone it still further in our own case. Where they have made great civic and social problems, we shall make them at a greater rate. Where their native population is perishing, as it is in Massachusetts and in other places, we, with our own tariff, condemn the people of our eastern cities to the same sterility.

THE WORK OF THE DOMINION EXPERIMENTAL FARMS

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(*Read 14th December, 1912.*)

Agriculture is the basic industry of Canada: it is the foundation upon which the Canada of to-day has been built and upon which she to-day rests. As it has been the pioneer occupation in this Dominion, so must it always remain the staple business of our people, influencing and determining by its development and progress the welfare and prosperity of our national life. To-day it employs directly more than half of our population.

Our commerce and our manufactures are directly or indirectly dependent for their expansion upon the country's harvests: as the latter increase in volume and value so will all other industries assume greater importance. In a word, Canada is essentially an agricultural, a food-producing country; as we are able to place more and more acres of our unoccupied lands under successful tillage, as we are able to profitably and without impairment of the fertility of our land increase crop yields, so shall we, in a very permanent and eminently satisfactory way, add to the nation's wealth, not only as regards agricultural products, but in the support and encouragement of every calling and occupation that makes for the country's good.

Another statement : Canada's cultivable land is her greatest and most valuable asset. And in saying this I am not unmindful of her many natural resources other than productive land, her mineral wealth, her immense forests, her large and valuable fisheries, her unsurpassed water-powers. All these as developed and properly conserved will indeed be ever-increasing sources of wealth, but nevertheless it will be the wealth and life as coming from our farms which will play the most important and vital part, which will contribute most towards the building up and prosperity of this country in its national life.

To support these contentions I may bring forward a few statistics regarding our tillable areas. In the nine provinces of Canada we have a land area of approximately 986,533,000 acres, of which at a very conservative estimate 36 per cent. (or 358,835,000 acres) is capable of occupation as farm lands. At the present time there is probably not more

than 8 per cent. of the total land area, or, say, 78,000,000 acres farmed or under settlement for agricultural purposes. Or, to consider the three western provinces only, Manitoba, Saskatchewan and Alberta, since it is towards them to-day the agricultural eyes of the world are more particularly directed, there are in this area, it is estimated, at from 170,000,000 to 200,000,000 acres suitable for cultivation, the greater part of which is adapted to wheat growing. Notwithstanding the rapid settlement of this vast land in recent years, probably not more than 8 per cent. is under tillage.

And it must not be supposed that the present provinces of Canada contain all our agricultural land. To the north and west of the Dominion lie the Territories of Mackenzie, Athabasca, and Yukon, and, leaving out of consideration the last named, it has been computed that there are at least 500,000,000 acres much of which may ultimately be capable of settlement. As yet we may be said to know very little as to the agricultural possibilities of this vast area, but this we can record, that wheat has been ripened at a number of points throughout it, as at Dunvegan and Fort Vermilion on the Peace River, the former 414 and the latter 591 miles north of the latitude of Winnipeg, and still farther north, as at Forts Providence and Simpson on the Mackenzie River, within 5 degrees of the Arctic Circle. Four years ago 30,000 bushels of wheat were harvested at Fort Vermilion, and there is satisfactory evidence that the Peace River country and much land even farther north will be found capable of producing wheat of excellent quality. Our northern limit for wheat growing is yet unknown.

And as to the value of our agricultural products as compared with the value of our other natural resources, let me say very briefly that according to the latest official statistics the total value for 1910 of farm products (field crops, live stock, fruits, poultry, dairy products, etc.) in Canada, consumed and exported, may be estimated in round numbers at $1,150,000,000, while for the fisheries we have for 1910-11 $29,965,433, for one year's cut (1909) from our forests $166,000,000, and for the mineral products (1911) $102,291,686.

If the foregoing has made good our contention as to the place of agriculture in Canada's development and prosperity, it is not to be wondered at that our governments, federal and provincial, should have shown such activity and generosity in recent years in providing means and establishing the necessary machinery for education in farming matters, for the solution of such agricultural problems as require scientific research and for giving assistance in such ways as may be practicable to the individual farmer in his everyday work. In the Dominion Experimental Farm system, the subject of my address to-night, we have the

chief means whereby the Federal Government has for more than two decades striven to assist and encourage Canadian agriculture.

In the year 1884 a Special Committee was appointed by the House of Commons to inquire into the causes for the depression that had for some years been experienced in Canadian agriculture and to suggest measures which might lead to a more prosperous condition of our farmers. This committee did its work thoroughly and well. In its report it was shown that farming methods, speaking generally, were primitive in character, irrational and wasteful, and that there was a widespread ignorance of those principles which must be observed if agriculture is to be placed and maintained on a permanent and profitable basis. Though there were some good farmers here and there throughout the country, who, by a judicious rotation of crops and the feeding of stock, kept up the fertility of their land, the rank and file were steadily impoverishing the soil, depleting it of plant food, by the sale of grain, hay, and potatoes, without any concomitant return as manure or fertiliser. And what was equally serious, as has been shown more particularly by our study of worn or partially exhausted soils, during the past twenty years, was the destruction of the humus or organic content of the soil following the irrational treatment of the land. We have come to regard humus as one of the soil's most important constituents, its loss not merely lowering the available food supply, but affecting disastrously those soil conditions, physical and biological, so desirable—nay, necessary—for the thrifty and vigorous growth of our farm crops. In a word, not only were crop yields going down, but for the most part the land under cultivation was markedly deteriorating.

After reviewing the condition of farming generally in Eastern Canada, for at that time the great North-West was scarcely entered upon, and asserting that the extremely unsatisfactory condition of our agriculture was largely due to haphazard and faulty methods, and certainly not the result of inherent deficiencies in our virgin soils or unfavourable climatic conditions, the Committee recommended as the chief remedial measure the establishment of Experimental Farms, which should be centres for experimentation and research in field and laboratory and the dissemination of information in all matters pertaining to agriculture, general and specialised. The report received the approval of the Government, and during the following session of Parliament, 1885-6, an Act was introduced and passed, almost unanimously, authorising the Dominion Government to establish a system comprising a Central Experimental Farm at Ottawa and four branch farms. The Hon. John Carling, then Minister of Agriculture, warmly favoured the proposed scheme, and lost no time in putting it into force. His first act was the appointment of

William Saunders, of London, Ontario, as Director of the system, this gentleman having already by special request examined into and reported upon agricultural experimental work in Europe and the United States. This choice proved a most fortunate one, for it is to the initiative, enthusiasm and the untiring energy of Dr. Saunders, who held the Directorship of the Experimental Farms from their establishment in 1886 till April, 1911, when he retired owing to ill health and advancing years, that the signal success of the system has been in a very large measure due. He had at the time of his appointment won recognition of a high order in the sciences of Chemistry and Botany and Entomology, and further, he brought to bear upon his work a very considerable experience in experimental agriculture and horticulture and in the art of landscape gardening. In the subsequent years he received many honours and distinctions from learned societies and universities at home and abroad, and for his invaluable work in promoting the interests of Canadian agriculture was in 1905 created by His Majesty, the late King Edward VII, a Companion of the Most Distinguished Order of Saint Michael and Saint George. Canada certainly owes a great debt of gratitude to Dr. Saunders for the splendid work he did for this country during the twenty-five years of his directorship of the Dominion Experimental Farms.

The five farms, the establishment of which was authorised in the Act of 1886, were all located and fairly well under way before the close of 1888. The sites for these were carefully chosen, not merely having in view readiness of access, as on a through line of railway, and, if possible, proximity to a large centre, but also the securing of land of a character representative of the district to be served.

The Central Farm, intended for the provinces of Ontario and Quebec, and to be the headquarters of the chief administrative officers and scientific staff of the system, was located at Ottawa. Here are the Chemical, Botanical and Entomological and other laboratories, fully equipped and with a force of trained men necessary to cope with the many problems requiring scientific investigation. The Farm, which is on the confines of the city, comprises in all some 465 acres. Of these about 100 acres are devoted to experimental work under the care of the Horticulturist, comprising 46 acres in fruits and vegetables, 21 acres in forest belt and tree plantations, and 33 acres in ornamental grounds and nurseries. From 25 to 30 acres are under the control of the Cerealist, for test plots and other investigatory work with the various grains. An Arboretum or Botanic Garden, under the care of the Botanist, occupies about 60 acres. The remainder, about 275 acres, furnishes the land necessary for carrying on the experiments in field and animal husbandry.

The four original branch farms were located as follows: Nappan, Nova

Scotia, for the Maritime Provinces; Brandon, Manitoba; Indian Head, Saskatchewan,for the area then comprising the North-West Territories; and at Agassiz, British Columbia, a point some 80 miles east of Vancouver, on the main line of the Canadian Pacific Railway. These, with the Central Farm, comprised the system until 1906, when the rapid settlement of Alberta seemed to demand points of investigation in that province. There was accordingly established in that year an Experimental Station for Southern Alberta at Lethbridge, for the purpose of studying problems in relation to the growth of crops under irrigation as well as those involved in agriculture under the so-called Dry Farming methods. In the year following (1907) a second Experimental Station for Alberta was established. This was located at Lacombe, about 115 miles north of Calgary, the climatic conditions and the nature of the soil in this part of Alberta being markedly different from those in the southern section of the province.

In 1908 an Experimental Station for Central Saskatchewan was located and equipped at Rosthern, within half a mile of the town of that name on the Canadian Northern Railway, and in 1910, a similar station for Northern Saskatchewan was established at Scott, on the line of the Grand Trunk Pacific Railway.

An Experimental Station for Prince Edward Island was established in 1909 at Charlottetown, occupying land on the outskirts of that city.

Still more recent (1911) are the two Experimental Stations placed in the Province of Quebec, the one at Cap Rouge, on the north shore of the St. Lawrence, near the city of Quebec, the other at Ste. Anne de la Pocatière, on the south shore, for the easterly portion of Quebec.

This year (1912) four more stations have been established, two in the East, at Kentville, Nova Scotia, and Fredericton, New Brunswick, and two in the West, at Sidney, on Vancouver Island, and the other at Invermere, on the Columbia River, British Columbia.

The system, therefore, at the time of writing comprises sixteen farms and stations, four of which are in their first year of operation. The establishment of several more stations is now under consideration, to meet the urgent demand by new settlers for special investigation in hitherto unoccupied territory. The multiplication of stations is made necessary by the varying climatic conditions prevailing in different parts of the Dominion, for it must be borne in mind that climatic conditions, rather than character of the soil, form the most potent factor in determining the nature and the possibilities of agriculture in any particular district.

The branch farms and stations are in charge of superintendents

who are in constant communication with the Director and chief officers at the Central Farm, by whom the principal lines of investigation, with details of procedure, are laid down.

In addition to the foregoing, experimental work is carried on at a number of sub-stations, as at Fort Vermilion, on the Peace River, at Kamloops, and at Salmon Arm, British Columbia, and at Forts Smith, Resolution and Providence, towards the northerly limits of our agricultural areas.

It would not be possible in the course of this address to enter into any detailed account of the work of the chief officers at the Central Farm —the supervision and management of the whole system by the Director, the planning of experiments in field crops by the Field Husbandman, and with animals by the Animal Husbandman, the testing of varieties and the selection and breeding of new cereals and their distribution by the Cerealist, the improvement of our grasses and fodder crops by the Agrostologist—the investigatory work with all classes of fruits and vegetables, including the originating and propagation of good varieties suited to the climatic conditions prevailing in the different parts of our Dominion, and the study of forestry problems by the Horticulturist—the feeding and care of poultry for eggs and marketable birds by the Poultry Manager—the thousand and one problems requiring chemical investigation for their solution coming within the purview of the Chemist, with soils and the economic maintenance of their fertility, with manures and fertilisers, with fodder crops and all classes of stock foods, with spraying materials for the control of insect and fungus pests, with cultural methods for the conservation of soil moisture, with farm water supplies, and with a host of other questions, for the Chemist's work is intimately interwoven with that of all the divisions of agricultural research—the investigatory work of the Botanist and Bacteriologist, whose studies are more particularly with a view to the control and extermination of those vegetable organisms which if allowed to propagate, would do enormous damage in our orchards and to other farm crops, and, finally, the equally important work of the Entomologist, who has the administration of the Destructive Insect and Pest Act, and whose constant study and care is to prevent or control the ravages of those injurious insects which, if permitted to flourish, would disastrously affect our fruit and forest trees, our field and garden crops, our farm live stock and even man himself. For all this I must refer you to the twenty-six annual reports of the Experimental Farms and the numerous bulletins issued by the Farm during the past quarter of a century. Or if you wish a more succinct account I can refer you to a "Guide to the Experimental Farms and Stations", issued two months ago, which contains a very readable outline of our varied activities.

For our present purpose, therefore, I have selected from our work a number of examples that may be considered typical of the whole and illustrative of the results achieved in the various lines of investigation. They are merely indicative; many others might be cited equally or possibly more important to Canadian agriculture, if time permitted. And I must present them in the briefest possible language.

THE MAINTENANCE AND INCREASE OF SOIL FERTILITY.

This is a problem of fundamental importance, since a productive soil must be considered a *sine qua non* whether general farming or one of its specialised branches is to be pursued with profit. Our study of Canadian soils has shown many points of difference between those naturally poor and those naturally rich, between those which have been exhausted by irrational and wasteful methods and those farmed according to the dictates of common sense and the teachings of science.

The richest soils in Canada are the black loams of the great north-western plains, many of which have been shown to contain from 18,000 lbs. to 25,000 lbs. of nitrogen, from 4,000 lbs. to 6,000 lbs. of phosphoric acid, and from 10,000 lbs. to 15,000 lbs. of potash, per acre, calculated to a depth of 1 foot—amounts of these essential elements of plant food far in excess of those ordinarily found in soils of the best quality. This great fertility must, as far as possible, be conserved, maintained, if this national heritage, this valuable asset, is to be handed on as it ought to be, unimpaired for future generations.

Many of our poorest lands are to be found in the East—the districts first settled. These soils very probably never equalled in richness those of the prairie provinces, but irrational methods have gradually but surely impoverished them. Their fertility must be increased if farming in these districts is to be placed on a profitable basis.

What is the outstanding difference between these virgin soils of high fertility, of great productiveness, and those worn, exhausted soils? It is that the former are characterised by large percentages of semi-decomposed organic matter (humus) and nitrogen, whereas the latter show but meagre amounts of these constituents.

Further, we find, save in the semi-arid districts of the far West, that there is distinct relationship between the organic content and that of the nitrogen, that methods which destroy the former reduce the latter, and *vice versa*. The humus of the soil is Nature's storehouse for its reserve nitrogen, slowly made available for crop use through the agency of bacterial life under favourable soil and climatic conditions. The important functions of humus—physical, chemical and biological—are only begin-

ning to be realised by our farmers, indeed by agricultural chemists—and we might very easily devote a whole evening to their consideration. But time now forbids. As an outcome, however, of this investigatory work is one fact that must not lightly be passed over. It is that the percentage of nitrogen, under ordinary circumstances, is a direct index of a soil's fertility, that nitrogen is the most important, the dominant, the limiting factor determining crop production. In a very real sense it is true that a soil's fertility may be measured by its richness in nitrogen. In saying this I do not wish to be understood as minimising the importance of the other elements of plant food furnished by the soil, but rather as emphasising the unique place which soil nitrogen holds and the necessity for its up-keep. And we have also in this connection the comforting fact that in rational, economic methods of enriching a soil in nitrogen we have the opportunity, constantly as it were, of keeping up a goodly supply of available phosphoric acid, potash and lime, and in preserving a favourable physical condition of the soil.

We must now pass on to consider briefly the methods that lead to the destruction of the humus and the dissipation of nitrogen, and on the other hand the means to be employed for the up-keep and increase of these constituents.

Their depletion, for instance, follows inevitably the practice of continuous grain growing, as commonly found, for example, to-day in the North-West, interspersed as it is with occasional summer fallowing for the purpose of conserving moisture and the eradication of weeds. Under such a system an investigation carried on at one of our Western Prairie Farms showed that in 22 years the soil lost to a depth of 8 inches more than 2,000 lbs. of nitrogen per acre, of which approximately 700 lbs. had been removed in the crops and the balance, 1,300 lbs., had been dissipated by the constant cultivation of the soil without any addition of humus-forming material. This soil is still an exceedingly rich one, and capable yet for many years of bearing maximum crops in favourable seasons, but chemistry tells the tale of impoverishment, and says that other methods must be adopted if the land is to be maintained in its high state of fertility.

We have areas in certain districts of the Maritime Provinces and Quebec once tilled and cropped, but now abandoned since they can no longer be profitably farmed. All taken, nothing put back. Their humus and nitrogen content have been largely dissipated, and this is undoubtedly the chief cause of their present unproductiveness. *Ex nihilo nihil fit.* Nature, in her slow but sure methods, is again restoring these worn-out, abandoned lands by covering them with vegetation, but soil building by

this process is extremely slow. The unwise farmer can do more harm to a soil in a decade than Nature can remedy possibly in centuries.

How, then, are soils to be maintained in a productive state and at the same time yield a profit for their working? First, in the keeping of live stock; in the manure so obtained we have the opportunity of restoring to the soil eight-tenths of the plant food taken from it in the crops they consume. In manures we have or ought to have the necessary and natural by-product of every farm. The farmer should recognise it as the home supply of plant food and humus-forming material—the chief means of holding and increasing the productiveness of his soils. This truth is not as yet fully realised by all our people. We do not keep sufficient live stock on our farms.

Many investigations have been conducted with manures, their right care and application, but we cannot now enter upon details. We have determined the tremendous losses in plant food, especially nitrogen, and in organic matter, that ensue by leaching and fermentation, when the manure is allowed to lie for months, as it frequently is, in loose heaps in the open barnyard. We have showed that while manure rotted under good conditions contains, weight for weight, more plant food than fresh manure, yet the losses in rotting may and very frequently do, outbalance the benefits. Our field and laboratory work alike prove that the safest storehouse for manure is the soil, and that the farmer who gets his manure while still fresh into the soil returns to it for the future use of his crops much more plant nourishment than he who allows the manure to accumulate in piles that receive little or no care, and which, therefore, must waste by excessive fermentation and leaching, or both.

Secondly, the land must be put under a proper rotation of crops. There are many reasons for this, chemical and physical. We have already learnt the disastrous effect on the soil's humus and nitrogen by continuous grain growing; the same would be true if we endeavoured to grow a hoed crop, as potatoes, for instance, year after year. The soil must be enriched by the sowing of a sod-forming, fibre-producing crop—in other words, the land must be occasionally laid down to grass. Much work has been done at almost all the Experimental Farms in testing out the merits and economy of different rotations, to meet the varying needs and conditions of agriculture as found in widely distant parts of the Dominion. As a lesson to be learnt from this work it may be stated that the Central Experimental Farm records furnish a number of examples of the good effects of proper cultural methods and right rotations upon the crop-producing powers of soils. As among the most striking might be cited the following:

In 1899 a system of crop rotation was introduced on that part of

the Central Farm devoted to general agriculture. At certain fixed prices for various products the value of the crop harvested that year was $2,776.66. Using the same prices as in 1899, the value of the crops off the same area in 1911 was $5,478.90, and will be considerably greater than this in 1912, all figures for which crops are not yet available. This shows the effect of good cultivation and right rotations on a given area.

As illustrative of the effects of such treatment upon the returns and profits possible from an acre of land the following figures are illuminating:

In 1910, according to the Census and Statistics Monthly, the crop value per acre throughout Canada was $15.50. The cost to produce this crop was about $9.60 per acre, therefore the net profit per acre was almost $6.00. On the Central Experimental Farm, using the same prices or values, the crop was worth $44.13 per acre produced at a cost of about $12.65 per acre. This leaves a net profit of $31.48 per acre for the Experimental Farm as compared with $6.00 for the average farmer or over five times as great a net profit. In 1911 the difference was quite as striking, while the returns for 1912 promise to be still more markedly in favour of the superior cultural methods which undoubtedly account for the difference. These and similar results are proving of the greatest value to the farmer of this country.

We may now proceed to say something of our investigatory work with legumes, Nature's soil enrichers, the only crop that leaves the soil with more nitrogen than it found in it.

The legumes constitute that great family to which the clovers, alfalfa, peas, beans and the like belong, and which alone of all farm crops are able to draw for their sustenance from that vast store of free nitrogen present in the atmosphere. This they are enabled to do—not of themselves, but through the agency of certain nitrogen-fixing bacteria in the soil and which attach themselves and reside in nodules or tubercles upon the roots of the legumes, passing on their elaborated nitrogen to their host for the building up of its tissues of root, stem, and leaf. The ancients knew of the value of clover as a soil enricher, but it was only in 1886 that Hellriegel and Wilfarth discovered the reason why. It was the agricultural discovery of the century, and the practical results following from it have proved of far-reaching importance and value.

For twenty-five years we have assiduously studied this question of the use of legumes as manurial agents in all its phases—in the field and orchard, in the experimental plot and in the laboratory—and we have also established their place as nutritive fodders of the highest rank. We have determined the amounts of nitrogen appropriated from the air and stored up in the roots, stem, and foliage of a large number of these

legumes. We have noted the increase of yield in crops succeeding them; we have ascertained the increase of soil nitrogen due to their growth, and we have investigated the merits of the various cultures put upon the market for inoculation of the soil with the nitrogen-fixing bacteria. The results of these researches would occupy several volumes, but I must try to condense them into two or three sentences.

Analyses have shown that from 75 to 150 lbs. of nitrogen may be stored up in a season, per acre, by the more common legumes. This is very largely from the atmosphere if the roots of the crop are nodule-bearing. The ploughing under of such a crop adds to the soil's store of reserve nitrogen, we may say, as much as would be furnished by an application of 10 tons of good barnyard manure. And this is but one of many advantages of this system of soil improvement. The plan of sowing clover with the cereal crops is now common in the older parts of the Dominion, and it is proving a very valuable one in the enrichment of our soils. The adoption of this method is, I believe, very largely due to the teachings of the Experimental Farms.

As regards increase in crop yields after clover, I may cite one of our many experiments. Series I comprised two adjacent plots, the one carrying clover the other carrying wheat. In the succeeding year both were planted with fodder corn; the crop from the clover plot exceeded that of the adjoining by 8 tons 480 lbs. per acre. In the following year both plots were sown with oats; the original clover plot gave 23 bus. 18 lbs. more per acre than its neighbour. Further, the third year after clover, both were planted with sugar beets; the yield from the plot that had borne the legume was 13 tons 1400 lbs. per acre more than that of the wheat plot. We invariably obtained an increased yield on the land that had carried the clover or other legume, for at least three years to a marked degree. Evidence of this practical nature is overwhelmingly convincing of the manurial value of the legumes.

In the determination by direct analysis of the soil of the amount of nitrogen that might become part and parcel of the soil through the continuous growth of clover, the results of one experiment may be cited. This plot of very poor sandy soil was first sown with clover in 1902, ten years ago, and has been continuously under that crop since that date. The soil was enriched at the outset with phosphoric acid and potash but no nitrogen was added. The nitrogen content was taken at the beginning of the experiment and every second year since. The net gain in organic nitrogen at the end of the ten-year period was approximately 500 lbs. in the first 4 inches of soil per acre. From other work we assume that the loss of nitrogen from various causes in such a light soil as that under experiment—almost a pure sand—must at least

equal the net gain, so that we may conclude the clover added to the soil in the neighbourhood of 100 lbs. per acre per annum.

And lastly, in this connection I have to speak of our work with bacterial cultures for inoculating the soil with those nitrogen-fixing organisms that permit the legume to draw upon the store of free nitrogen in the atmosphere. The details of this investigation are very voluminous, for the merits of many European, American and Canadian cultures have been tested in pots and, on a larger scale, in half-acre plots. It must suffice now to say that while some proved effective in promoting the growth of the legumes, many proved worthless, no doubt due largely to the susceptibility of the organisms in the cultures to light and heat. Their vitality becomes seriously impaired with the keeping of the preparation. Cultures, therefore, unless fresh cannot be depended upon, and experience has taught us that the best inoculating material for clover or alfalfa is the surface soil from a field that has recently grown clover or alfalfa.

About 300 lbs. of soil are required per acre, broadcasted and harrowed in. This is the surest and most direct method of inoculation. Such soil can be obtained from nearly all the Experimental Farms on payment of a small fee to cover the necessary freight charges.

Though it has been conclusively shown that there are districts in which inoculation is useful, it should be noted that inoculation is not generally necessary. The nitrogen-fixing bacteria are not restricted to a few small or isolated areas—our observations have proved that—and we have reason to believe that many failures with clover have been due to lack of moisture, poverty in humus, sourness or an unfavourable mechanical condition of the soil, rather than to absence of these valuable organisms.

Perhaps at this juncture I should say something of the use of the so-called chemical or commercial fertilisers. Have they a place in a rational, economic farming system? We believe they have, but it must be secondary to the means I have outlined for the up-keep of fertility. Fertilisers are no substitute for farm manures, though they can frequently be used profitably as supplemental to manures. They furnish plant food in available forms, but they do not add humus-forming material, so necessary to the formation of a comfortable habitat for plants and the retention of a due proportion of moisture. They are frequently a snare to the poor farmer who depends solely upon them, but they may be employed with great profit at times by one who conducts his operations on rational lines. The farmer who would use them with profit must keep up the organic content of his soil and be prepared to do some experimental work. In general farming they have not as yet

been largely employed, nor do we advise such use unless the farmer understands their character and properties; but the time is coming, especially in the older portions of the country, when they will be more extensively employed. Hitherto it has been the fruit grower or other specialist who has reaped the greatest benefit from them.

FIELD CROPS.

Experimental work with the ordinary farm crops has naturally received much attention. The influence of rotations and of drainage, the cultivation of the soil and its manuring, the preparation of a good seed bed, the effect of early and late seeding, the use of pure seed of strong vitality and many other factors in crop production have been carefully and thoroughly studied.

The testing of newly introduced varieties of all classes of crops has always been a strong feature. These include cereals, grasses and forage and farm crops generally. An annual bulletin on the subject informs the farmer as to the merits and yields of the different varieties and strains offered for sale by seedsmen. The plot and field work in many instances is supplemented by analysis, so that we have been able to place on record data as to the composition and nutritive values of many grasses, native and introduced, of varieties of Indian corn as grown for fodders and the silo, of different strains of mangels, carrots, turnips, etc., etc. We have also worked out the stage of growth at which Indian corn, certain grasses, clovers, etc., should be cut, so that the harvested material may be at its best, both as to composition and digestibility. The excellent quality of the self-cured western prairie grasses has also been demonstrated.

SUGAR-BEETS FOR FACTORY PURPOSES.

The more important factory varieties of sugar-beets have been grown on the larger number of the Experimental Farms and Stations. Representative samples of these are submitted to analysis year by year, as to sugar content and purity. We have ample evidence that as regards these two important points very satisfactory sugar-beets can be grown in many parts of Canada.

CANADIAN CEREALS.

Red Fife wheat as grown in the Canadian North-West has earned for the Dominion the enviable reputation of being one of the finest wheat-producing countries in the world. The very high breadmaking qualities of the flour from Red Fife is admitted in all the markets of the world. There remained, however, an important field for experimenta-

tion in the production of earlier ripening varieties, better suited to northern areas of the Dominion, characterised by a short season. This problem of finding a spring wheat of the quality of Red Fife but which would ripen before there was danger of early autumnal frosts was entered upon in the early days of the Farm System and from that time until now many hundreds of new kinds have been produced by cross-breeding, using for this work chiefly Red Fife and early ripening sorts from India and Northern Russia. Among the new cross-bred varieties of very high productiveness and of early ripening habit are the Marquis, Preston and Huron, the first named being the most noteworthy. Marquis is now displacing the others (and also Red Fife) in many wheat areas of the North-West. It is about a week earlier in ripening than Red Fife, produces usually from 10% to 60% more crop (in Saskatchewan) and yields flour of the same character as Red Fife. It won the highest award this year and last year in international competitions open to the world for the best hard wheat.

Prelude, just being introduced, ripens about two weeks before Marquis and gives a good yield of very hard plump wheat. Its flour is of the highest rank for baking strength but has a slightly yellowish tinge. This wheat may prove of the greatest value in Northern Saskatchewan and other northern districts, in which specially early ripening sorts must be grown to escape frosts.

Concurrently with this research by the Cerealist and to supplement his results in the Baking laboratory, chemical and physical analyses have been made of many of the cross-bred wheats so obtained. The information so gained has proved of considerable assistance in discriminating between these new varieties.

In barleys more than a hundred cross-bred sorts are now being studied. A selected type of Manchurian has been introduced with excellent results.

A new cross-bred variety of peas, the Arthur, has proved the earliest of all-round yellow field peas and of unusual productiveness. It is now being actively introduced with very gratifying results in almost all sections of the country.

The annual distribution of seed grain is an important work also in charge of the Dominion Cerealist. Samples of new and improved varieties of wheat, oats and barley have, on application, been sent to farmers who will undertake to sow them according to instructions and report on the growth, yield obtained, etc. By this means information has been obtained as to the merits of different varieties under widely varying conditions of soil and climate, and much good achieved by the introduction and dissemination of the best sorts of grain.

Reference has already been made to investigations carried on conjointly by the Cereal Division and the Division of Chemistry, and as a further illustration of this class of work I may cite our search for a chemical basis for determining the breadmaking value of a flour, an analytical method that would give results in accord with those from direct baking trials. Our data on this matter are perhaps more voluminous than satisfactory, but nevertheless we have made some headway in determining "strength" of flour by chemical means. We have in certain very important particulars been able to correlate the baking and chemical results.

The influence of soil and climatic condition on the composition of wheat and barley has been carefully and systematically studied for a number of years by the Chemical Division. This research has thrown much light on the cause of the high quality of our northwestern-grown wheats. We have found that the amount of available soil moisture together with the temperature prevailing during the period in which the grain is filling are important factors in determining the character of the grain. A fairly dry soil accompanied by high maximum temperatures, such as we usually find over large areas over the North-West during later summer months, arrest vegetative growth of the plant, hasten maturity and conduce to a hard berry with a high percentage of gluten. On the other hand, grain grown with an abundance of moisture and conditions conducive to the lengthening of the vegetative period will be starchy and "soft". The highest type of malting barley is one possessing a low percentage of protein, and such we may look for when grown under irrigation.

Among other investigations in which the Cereal and Chemical Divisions have collaborated may be mentioned, "The influence of artificial bleaching on the quality of flour" and "The influence of storage on the composition and breadmaking value of flour".

HORTICULTURAL WORK.

We must now pass on to speak of the experimental work in the field of horticulture, a very wide and varied field, and a work that has yielded most valuable results to the fruit-growing interests in all parts of the Dominion. Here, as all through this account of our investigations, I can only take a few examples which may illustrate the scope and character of the work.

And, first, in connection with apple growing, I would remind you of the classic work of Dr. William Saunders in his attempt to obtain an apple that would endure the rigorous winters of the prairie provinces. This was begun in 1894 by cross-fertilising the flowers of the extremely

hardy Pyrus baccata with pollen from many of the hardiest and best sorts of apples grown in Ontario. Many hundreds of such crosses were made, and later many hundreds of seedlings from the first generation were raised. Almost all of these proved perfectly hardy under the severe tests they were submitted to in the North-West, and their fruit, though small, was found admirable for jelly-making. Second crosses were made using cultivated varieties, and from these and other crosses trees have been grown that apparently are hardy and which have yielded fruit of fair size and in some cases of excellent quality.

Of the many lines of experimentation now being carried on in apple breeding and testing by the Dominion Horticulturist, the following may be cited: (1) The testing of varieties as to hardiness, prolificness, flavour of fruit, etc., when grown in widely distant points throughout the Dominion. (2) The testing of seedlings from seed of between 400 and 500 named varieties growing in our orchards at Ottawa. This means that only one parent of these seedlings is known, natural pollination having taken place from other trees in the orchard, many of which furnish apples of the best flavour and quality. Many of these seedlings have fruited and the results are surprisingly good. Over 70 per cent. have been found of marketable size and of good quality. (3) Cross-breeding experiments have been conducted for the past 12 years, more particularly with the view of obtaining hardy, vigorous trees producing an apple of good flavour and of long-keeping quality. Only a few of the trees so produced have as yet fruited, but the prospects of success are excellent. (4) Individualism in apple trees is being investigated. For 15 years the yields from the trees under experiment have been recorded, and as a result it has been noted that a marked variation as regards prolificness exists between trees of the same variety and age and grown under the same conditions. Some trees have yielded from two to four times as much as others. Scions have been taken from these heavier yielding trees and top grafted to learn if this individuality can be perpetuated.

In all sorts of small fruits and vegetables testing is carried on at Ottawa and on the branch farms. As a result we are in a position to advise as to the best varieties suitable for growth in the different parts of Canada.

Cover crops for orchards have long been under experiment, for protecting the roots of trees in winter and adding humus and plant food when ploughed under. For the most part these crops have been legumes or nitrogen-gatherers (clover, vetches, beans, etc.), but some others, such as rape and rye, have been included. The system of orchard management which comprises the use of cover crops with clean culture is now widely adopted; it appears to be the most economic and effective

method for the control of soil moisture, the up-keep of fertility and winter protection of the trees. In a large part of this work the Chemical Division has co-operated, so that the information gained might be as complete as possible.

We were, I believe, the first in Canada to advocate the spraying of orchards, and experimental work in connection with this practical and effective means of controlling insect and fungus pests has always been a prominent feature of our horticultural programme. Much advance has been made in the last twenty years in this matter, and the data obtained in the orchards of the Central Farm with Bordeaux mixture, various arsenites and arsenates, lime sulphides, etc., etc., have enabled us to advise our fruit growers respecting the value and use of the various manufactured and home-made fungicides and insecticides. In this inquiry chemical work as to the composition and preparation of sprays and spraying materials has gone hand in hand with the practical trials in the orchard and thus made the results more valuable.

ANIMAL HUSBANDRY.

Experiments in the breeding, feeding and care of live stock have been carried on at the Central and most of the branch farms. Many lines of work have been conducted with horses, cattle, sheep and swine. One or two examples may suffice to bring before you the character of this work and the value of the results.

Experiments in beef production have conclusively shown that as the animals more nearly approach a typically beef type, the greater the profit that may be expected. Scrub animals make poor use of their food.

The economy in feeding a liberal allowance of succulent roughage, e.g., corn ensilage and roots, has been demonstrated, and that among the coarse, dry fodders, clover and alfalfa hays have proved more nutritious than the more commonly used timothy hay.

All the more important concentrates, milling by-products, etc., have been tried in various proportions and well-balanced rations therefrom compounded.

The influence of age on the cost of making gains has been well worked out; the older the animal the more expensive the increase in live weight.

More profit is attached to the practice of feeding steers so that they may be ready for the block at an age of two years or less than to the plan of taking three or four years to bring them to a condition fit to kill.

Dehorned steers, fed in box stalls loose, say 8 or 10 together, do better than steers fed tied, on the same food.

With dairy cattle our experience has shown that as regards milk and butter production individuality is a very important factor. Admitting that we have breeds specially adapted to dairy purposes, e.g., Jersey, Ayrshire, Holstein, etc., the best individual must be looked for among them rather than a comparison made between the breeds. This entails the constant testing of the milk and a daily record of yield. There is no best breed, all points considered.

The feeding of ensilage or other succulent fodder is essential to cheap milk production, especially in the winter season, and the hays of clover and alfalfa may be used with profit to reduce the meal portion of the ration.

The practice of "soiling" or feeding green forage allows a larger number of cows to be maintained on a given area than if the land is pastured, and is to be considered as essential to intensive dairying. Many "soiling" crops (e.g., peas, oats, rye, corn and clover) have been tried and reported on with special reference to their value for supplementing the pasture during times of drought and as the season advances.

While the total quantities of milk and butter fat in a given period may be influenced by the feeding, it does not appear that the percentage of fat is appreciably affected by the character of the feed.

In the breeding and feeding of swine several thousands of animals have been used. The stock experimented with for the most part has consisted of Yorkshire, Berkshire and Tamworths. Among the more important lines of investigation might be mentioned the breeding of animals specially suited for the production of export bacon. The importance of this work is obvious when we remember the very large proportions to which our trade with England in this commodity has grown.

And in this connection I may briefly refer to an exhaustive examination into the character and causes of "Soft Pork" undertaken by the Division of Chemistry—an investigation that lasted three years and in which more than 300 pigs were put under test. We were able to establish by chemical analysis that certain rations, and especially those containing a large proportion of Indian corn, produced an undesirable bacon by reason of the high percentage of olein in its fat. And among other important findings we learnt that there was no better corrective to this undesirable quality of softness than the by-product skim milk, the addition of which to the grain ration tended also to thriftiness and rapid growth.

The summer and winter housing of swine and the profitable use of summer pastures and green succulent crops for growing pigs, are among the numerous other matters relating to the swine industry that have been investigated.

Special attention has been given, more particularly in recent years, to the best construction of buildings for the housing of all classes of farm stock, having in view efficient lighting and ventilation, factors of the highest import to the health and thrift of the animals.

EXPERIMENTAL WORK IN POULTRY.

The poultry industry in Canada has of late years rapidly advanced, and to supply the information and advice asked for by the ever-increasing number of poultry keepers, much experimental work has been undertaken. This has been chiefly conducted at the Central Farm.

This work has naturally fallen largely into two lines: The breeding, feeding and care for egg production and the breeding and feeding for first-class table fowl, and many valuable data have accumulated in the course of years in both branches. In a very condensed form I may present some of the more important results:

1. Variety in rations is essential to good egg production, and especially so during the winter season. The value of freshly crushed green bone, meat meal or other good animal food, as well as a certain proportion of green stuff, in addition to the mixed grain feed, has been established.

2. In egg production, individuals differ widely and our results have shown the wisdom of systematic breeding from hens of known laying capacity.

3. For properly fattened fowl birds of the right type should be used. They may be fattened in coops, and crushed, sifted oats with barley meal and fine shorts mixed with skim milk has been found a preferable ration and one that has given birds of the highest market value.

Here as with other classes of live stock, proper housing has been a subject of experiment, and the so-called "cotton-front house" has been found conducive both to the health of the birds and a good egg production.

BOTANICAL WORK.

No institution of agricultural research would be complete without a scientific staff and properly equipped laboratories for the study of those parasitic organisms to which are due so many diseases that attack our economic plants. It would appear that as the area under cultiva-

tion increases, as cultural methods become more intensive, and "improved" varieties of crops are employed, the "improvement" of which consists chiefly in the power of returning under favourable conditions a larger yield, without reference to their power of disease resistance, serious diseases become more frequent in their occurrence and more destructive in their effects, unless special measures are taken to safeguard crops against them. Hence there is much work for the plant pathologist who, by microscopic examination and cultural methods in the laboratory and experiments in the greenhouse or field, isolates the organisms which produce the diseases, studies their life history, determines experimentally the conditions under which they become destructive and the measures which may be successfully undertaken for their control. Fungus diseases do much harm to orchard and field crops, reducing yields and lowering the value of such produce as may be obtained. Not infrequently the loss from a single disease of one particular crop may in a season favourable to the disease amount to thousands of dollars, as, for instance, in the case of Fire Blight of apple and pear trees, or smut of wheat, or Late Blight of potatoes. These diseases cannot be ignored. It is doubtful if there is a single crop immune from their attack and, generally speaking, the more important the crop the greater the number of diseases to which it is subject. It is, therefore, the duty of the Botanist to carry on inquiries and investigations respecting the control of the diseases which appear to most seriously interfere with the work of the agriculturist and horticulturist in this country; to keep himself informed of what is being done along similar lines at other centres of investigation; and to utilise the results of his own work and those of his co-workers to furnish to the perplexed cultivator the best information available on the subject. Among the diseases more particularly under investigation at present are the Silver Leaf of fruit trees, Black Rot of cherry and plum, Scab, "Rhizoctonia" and other diseases of potatoes and Smut diseases of grain.

The difficult problem of working out methods for the control and eradication of noxious weeds and poisonous plants is another and important feature of the Botanist's work.

The Botanist also has charge of the Arboretum at the Central Farm in which there is to be found an extensive collection of hardy trees, shrubs and perennials, the result of many years' experimentation with plants from many distant parts of the world. In addition, an effort is being made to gradually bring together a collection of native plants which shall comprise all representatives of the Canadian Flora hardy enough to be grown at the Farm without special protection, to-

gether with such other plants as from their importance in the arts, industries or medicine are of special interest. This Arboretum or Botanic Garden occupies 60 acres in a commanding position, and contributes not only a very pleasant park, but a place of great educational value to the lover of trees and plants.

ENTOMOLOGICAL WORK.

As in the case of the Botanist, the Entomologist's chief work is towards the protection of trees and fruits and crops generally against the ravages of pests, but here we have to do with injurious insects that attack and destroy, and which, if left unchecked, would soon make our agriculture profitless. As already intimated, the work of the Entomologist includes the study of insects affecting live stock,such as the horn-fly, ticks, mites, etc. Apiculture and the production of honey also comes within the scope of this study.

The study of the life history of injurious and beneficial insects carried on in laboratory, insectary, field and forest, is essential as a first step towards the formulating of effective and practicable methods for their control or destruction. It is a work, therefore, of primary importance, and consequently one to which much close attention has been given.

More recently among the many methods of control is that of keeping in check the development and spread of injurious insects by the introduction and distribution of parasitic insects. These natural means of control, as they may be called, bear much promise, and the Dominion Entomologist has already met with some success in this comparatively new sphere of work, and there is great hope that he may still be more successful in stamping out, or at all events in preventing the spread of certain insects otherwise uncontrollable.

For the purpose of introducing, studying and establishing the natural parasitic enemies of insect pests in localities in which the latter are prevalent, a most important development of the entomological work has been recently made in the equipment of field entomological laboratories in different parts of Canada. Six such entomological stations were established during the past year, and even in the first year of their history important results have been obtained. One of the most interesting of these is the introduction, establishment and proven spread in New Brunswick of an important European parasite of that dangerous pest, the Brown Tail Moth. In Nova Scotia, Quebec, Ontario and British Columbia valuable and encouraging results have already been obtained in the laboratories established in these provinces.

The Entomologist has also the administration of the "Destructive Insect and Pest Act", passed in 1910, to prevent the introduction into Canada and spreading of insects and other pests injurious to vegetation. Under the regulations of this Act, trees, shrubs and nursery stock may only be imported into Canada during certain specified periods of the year and through certain ports, of which there are nine in the Dominion. At six of these ports fumigation stations have been established where certain classes of trees and plants are fumigated with hydrocyanic acid to prevent the introduction of San José and other scale insects.

Plants from certain countries are inspected either at the port of entry or at their destination. The protective value of this inspection work has been frequently demonstrated by the discovery of such serious pests as the Gipsy and Brown Tail Moths and certain scale insects on imported trees.

Many other aspects of the Entomologist's work of controlling and eradicating the countless insect pests affecting man in all his activities and his pursuits might be referred to, but space will not permit. I would, however, mention the important investigations that have been made in recent years by the Entomologist at Ottawa, respecting the ubiquitous house-fly, its menace to health and the means for its suppression.

CHEMICAL WORK.

And lastly I come to speak of the work of the Division of Chemistry. Of its fundamental and varied character you will have judged from the many references made in this address to the aid that chemical research has given towards the solution of the numerous problems in general and specialised farming. The relationship that exists between modern and progressive agriculture and chemistry is a very important and intimate one, so that we may say with a very large measure of truth that up-to-date farming is putting into practice the teachings of agricultural chemistry. The requirements of crops and animals, the constitution and needs of soils, the most economical means of maintaining and increasing soil fertility, the nature and amounts of fertilizing ingredients in manures, the relative nutritive value of forage crops and cattle foods, the composition of dairy products, the constitution and preparation of fungicides and insecticides, all these and many more form the subjects of chemical research and analysis. I shall but indicate some of the more important of these investigations now in progress, omitting mention of those already alluded to in the course of this address.

Canadian Soils.

The chemical and physical examination of virgin soils and those from unoccupied areas has always been a matter of particular interest

to us. The value of the data so obtained will be apparent, not only for the present but for the future successful farming of these lands. Soil analysis is a tedious affair, but we have during the course of years put on record the data of many types of soils found in the Dominion. Two years ago we were able to issue an important bulletin on the Western prairie soils, which has received wide recognition. This work continues, and our labours in this connection have been extended in recent years to typical soils from Nova Scotia and New Brunswick in the East and British Columbia in the West. We have found the knowledge so gained of much assistance in advising our farmers respecting the economic up-keep of these lands and in the use of manures and fertilisers.

Conservation of Soil Moisture.

In districts of sparse rainfall, as in certain parts of North-Western Canada, in which, unless there be provision for irrigation, the so-called "dry-farming" methods must be practised, the question of the absorption and retention of moisture by the soil is all-important. The principles of moisture conservation are fairly well and widely understood, but there yet remain many features in the economical working of the soil to be satisfactorily settled. The value of sub-soiling, the depth and time of ploughing, the frequency, nature and depth of surface cultivation, the value and kind of sub-surface packing are all points requiring investigation on both heavy and light soils. In the autumn of 1910, therefore, an exhaustive series of experiments in soil culture was planned by the Agriculturist and Chemist, to be carried out at a number of the Western Experimental Farms, to learn the effect of various cultural treatments on crop yields and with the hope that these yields might be correlated with the moisture content of the soils. To this end determinations of the moisture in samples taken to several depths from the experimental plots at regular intervals throughout the season have been made. The results indicate the influence of the several cultural methods under examination on the moisture content of the soil to a depth of 5 feet. Several hundreds of such samples have been examined monthly during the past two seasons. We find that the moisture content of the soil may be profoundly modified by the nature and time of treatment employed, and several facts of considerable practical importance in the working of the land, looking to a greater conservation of moisture, have been brought out.

The Fertilising Value of Rain and Snow.

The nitrogen compounds present in the rain and snow as falling at Ottawa have been determined since 1906. This investigation is being

made in concert with agricultural chemists in many parts of the world with a view of determining the value of rain and snow as suppliers of nitrogenous plant food and of ascertaining the differences that may exist in the atmosphere in various countries in respect to richness in nitrogen compounds. The average per annum for the past five years so supplied is 6.18 lbs. of nitrogen per acre.

Water Supply of Farm Homesteads.

Because of the practical importance of the work I cannot omit some mention of the examination of waters from farm wells, creameries and cheese factories. Every year we find an increasing interest in this matter of a pure water supply on the farm, and though not of the nature of a scientific research, I have every reason to believe that our labours in this connection—which means the examination of some hundreds of waters annually—have been instrumental in improving the supplies of the farm homesteads throughout the length and breadth of the land. There is no better watered country in the world than Canada, but too often, alas, health has been sacrificed to convenience, and the farm well, because badly located, is a source of disease rather than one of good health.

In closing, a few words must be said about our directly educational work. In addition to our reports and bulletins, there is a very large and ever-increasing correspondence in all the departments. Farmers have the privilege of writing us without even the cost of postage on their letters, and they have not been slow to avail themselves of the privilege. Questions on all matters relating to general and special branches of farming daily pour in upon us, so that I can truly say we have become a Bureau of Information on agricultural subjects. And we encourage this branch of our work, for we seek, as we have done from the first, to keep in touch with the farmers and make the institution one of real assistance to the man on the land. In this, I believe, we have met with signal success, so that to-day the attitude of the farming people generally towards the Farms is one of confidence and receptiveness—an attitude that must tend to an ever-widening of the usefulness of the system.

The Experimental Farms have undoubtedly exerted an influence of great practical value throughout the length and breadth of the land, and I trust I may have been able in this imperfect and fragmentary presentation of their work, not merely to justify their existence but to furnish evidence of the wisdom and forethought of the Government in their establishment.

THE CHIPEWYAN INDIANS.

BY THE RIGHT REV. BISHOP OF KEEWATIN.

THE Chipewyans, or Chips, as they are generally called, are the most northerly of any of the Indian tribes, and abut on the Barren Lands of the North. In bygone days there were constant feuds between them and the Eskimos, but for many years they have lived peaceably together, though they never hunt on the same grounds, and they never intermarry.

They are looked upon by most Europeans who have come in contact with them, as the most dirty and degraded of any of the Indian tribes, and they certainly give this impression. They have without doubt at some past time been greatly oppressed, for they remind one very much of a beaten cur, with his tail between his legs; and yet when one lives among them in their hunting grounds there is far more nobility and push in them than one dreams of, and they are very hospitable and generous, though they seem almost without any sense of gratitude. "Thank you" is not to be found in their language, and on receiving any gift they never show the slightest pleasure, yet they are not ungrateful.

The following from "Butler's Wild North-West" gives a very good account of these Indians:

"The Chipewyans are found at Churchill on Hudson's Bay, and at Fort Simpson on the rugged coast of New Caledonia, but stranger still, far down in Arizona and Mexico, even as far south as Nicaragua, the gutteral language of the Chipewyan race is still heard, and the wild Navajo and fierce Apache horsemen of the Mexican plains are kindred races with the distant fur hunters of the North. Of the many ramifications of the Indian race this is perhaps the most extraordinary.

To the east of the Rocky Mountains these races call themselves 'Tinne' (at Churchill, 'Dinna'), a name which signifies 'people', with that sublimity of ignorance which makes most savage people imagine themselves the sole proprietors of the earth.

Many subdivisions exist among them: these are Copper Indians, and the Dog Ribs of the Barren Grounds, the Louchew, or Kutchins, a fierce tribe of the upper Yukon, the Yellow Knives, Hares, Nehanies,

Sickanies, the Tahas of the Mountains and the Mackenzie River, the Slaves of the Great Slave Lake, the Chipewyans of Athabasca and Portage la Roche, and the Beavers of the Peace River.

West of the Rocky Mountains the Carriers, still a branch of the Chipewyan stock, intermingle with the numerous Atnah Races of the coast. On the North Saskatchewan a small wild tribe called Surcees also spring from this great family, and as we have said, nearly three thousand miles away, in the tropic plains of old Mexico, the harsh, stuttering 'tch' accent grates upon the ear. Spread over such a vast extent of country it may well be supposed that they vary much in physiognomy."

CHIPEWYAN STORIES.

BY THE RIGHT REV. BISHOP LOFTHOUSE.

CHAPTER I.

THE ANIMAL AGE.

AT the beginning there were no people, only animals; still they resembled human beings, and they could speak: when the animals could speak it was summer, and when they lost the power of speaking winter followed.

A squirrel came to them and foretold the coming of winter, and they all began to cry at the news. All the animals then ascended into the sky, to meet some person they saw there: this person told them to return to the earth, and said, "My son is on the earth to watch the deer crossing the River". The man who watched the River told a mouse that when he saw the deer crossing the River, he would come out in a canoe to kill some of them. The deer were made acquainted with this man's evil intention against them; they therefore said to the mouse, "When you see the man coming in his canoe, you swim out to him and cut his paddle in the middle so that he will upset before he gets to us, and be drowned".

The mouse cut his paddle and the canoe consequently upset, but the man got safely to shore. In this man's canoe a bag was found by the deer which contained Summer. After this they followed the man to some place where they saw his Father in the sky.

When they came to their destination the bag was opened: all kinds of Fish were found in it. A Jackfish was the first to come out of the bag: he was followed by the rest of the Fish and the animals in search of the earth.

The place they came through in the heavens, after their exit, appeared as if closed. When all these fish and animals were following the Jackfish looking for the earth, a second partition of the bag burst and let out Summer or heat. The arrival of the Summer melted the snow, and then all the earth was covered with water, except one place, where they saw a man whom they requested to dry up the water. Upon this he drank it all up.

A Lynx then came to him, and said, "My Grandfather, the earth is now so dry that neither I nor any of the other animals can travel on it for want of water; we shall all die of thirst; tell me where you put the water". He told the Lynx he had drunk it. Upon this the Lynx asked permission to put a pan on the part of his body where the water was. Having obtained this permission, he put the pan on the man's stomach, and the water began to run over the earth in Rivers, the beds of which the man traced, and formed with his staff.

The animals now began to get scarce and to die of starvation, especially the deer. Summer hawks could be seen watching for the deer that they might kill them; they always knew where they were by noticing where the crows hovered about. The wolves, foxes, and other animals which prey upon the deer profited by the same signs, but a number of them starved before they came up with the crows, and the rest found that there was a partition between them and the deer. A Whiskey Jack picked a hole through the partition and brought out some fat on his beak for the wolves and other friends. The partition was made of the tripe and inside fat of the deer. A Lynx now got his nose through and received a blow from a deer which caused him to have a dinted, short snout ever since. The deer immediately left the place and spread over the earth.

CHAPTER II.

THE AGE OF MAN.

At the first there was a man, an old woman and her daughter, who was the man's wife. These three began to travel. The man came first to the place to which they were going. The old woman who was behind killed her daughter, who was with child; she skinned her daughter's head, and put the skin on her own head as a mask. When the man came home he found her in the tent with her body bent, and he took her to be his wife. He asked her why her head was bent down, and on receiving no answer caught her by the hair to lift up her head, but instead of that he took off the skin that covered it, and found her to be the old woman.

The man then went in search of his wife and found her body with the head off, and the child, which the old woman had cut out of her womb, lying beside it. He burnt the bodies of his wife and child and lay down to sleep on their bones; when he awoke, his wife and child were sitting beside him. They started back to the tent where the old woman was, and the wife told her husband to mark the ponds and creeks he passed whilst they were travelling.

The man who always travelled ahead, passed a small pond which he did not think it necessary to mark. When the old woman, her daughter and child came to this pond, they sat down; the man meanwhile continued his journey until he pitched his tent. When he became anxious to know what delayed his family, he went back to look for them. When he arrived at the pond he had not marked, he found nothing there but a Beaver house, and the pond that before was so small was now increased into a large lake. He called out for his family and was answered by the inhabitants of the Beaver house, "We are not human beings now, but Beaver". The disconsolate husband then returned to his tent alone, where he remained for a few days. He had a pair of snowshoes partly made whilst his wife was alive and he now used to add a little towards their completion every day. Several times when coming home from hunting he noticed a bird coming out through the tent chimney. One day he stopped this up, and also another hole that was in the tent, and when he returned home that day he found his wife sitting there. Henceforward he hunted nothing but Beaver, for there were a large number on the lake. After killing a few, he desired his wife to live on the meat, and he would eat the grease. Once on coming back from hunting the Beaver, he saw his wife's fingers were rather greasy, and he accused her of stealing the grease. He was so much displeased with her that he said, "Always look at the moon at night, and you will see me there".

The wife was now left alone without any companion but a dog. She then went to a certain place with the dog. A man with whom she was acquainted met her at this place and lived with her for a short time. From this couple descended the human race.

CHAPTER III.

THE MAN WHO MARRIED THE MOUSE.

Two brothers went off in a canoe and found a lot of young geese which they tied together to make a raft. Both fell asleep in the canoe, and when they again opened their eyes the geese appeared to have grown to full size. They went ashore and came to a rock, to the top of which they went, and saw there a house inhabited by a man, his wife and son; the man was not at home so both brothers sat down in the house till he should return; when he returned he told his wife that the two brothers were of a smaller race of people than his.

He had a very large fish out of which he took the eyes to make grease for his guests, and he also made them bows and arrows; these with a lump of grease each he gave to the brothers, and said that this grease would never decrease in size, and that if they killed anything with the arrows, which they could not get, they had only to sleep, and on awakening they would find it beside them.

The elder brother shot his arrows into the air, and they always kept ascending, and would not come down; he tried to recover them, but when he had ascended some distance in the air he could not come back, and began to cry. His younger brother cried in sympathy, and was transformed into a wolf. He that was in the air now got to the ground, and asked his brother why he had become a wolf; he then said, "When I see foxes, hares and rabbit tracks I'll know I am on the earth". After this he travelled, and saw squirrels, mice, and other small animals, and shortly after came to a house which he thought belonged to them. He found an old woman in the house; she had two daughters, one of whom was a mouse, the other a squirrel. When she wanted anything killed she sent one of them to do the job. A man came to the old woman, who dressed him, and who wanted one of her daughters to take him as her husband. When the maidens came home their mother told them to sit one on each side of the man, and she to whom he should turn his face was to be his bride.

The man lay down between the sisters, and when he awoke he found himself beneath the ground. A wolf that happened to pass that way took pity on him, and with a deer's tooth dug him out, and then made him two arrows. "One of these arrows", said the wolf, "is a man, and the other a woman, and you are to kill buffalo with them." He killed two buffalo with the arrows.

The old woman, the squirrel, and the mouse shortly after turned up, and he sent them for meat when the squirrel was killed by the wolf. He of the arrows took the other girl, *i.e.*, the mouse, for a wife, and continued hunting the buffalo, attended by his Mother-in-law, the old woman who made lines of the buffalo hides. These three appeared at this time to be in an upper level or story of the heavens, and the lines were used to lower the man down to the earth; he landed near an Eagle's nest; the old Eagle ordered the young ones to pounce upon the man, and eat him; then the young Eagles told the Indian to get under their wings and hide from the old Eagles. When the parents of the young birds came home they said to the young ones, "You smell very much of Indian." The young ones answered, "Did you not bring an Indian to us; well we have eaten him, and that is why we smell of Indian".

When the old birds left the nest again the young Eagles stuck some feathers upon the Indian, who was thereby enabled to fly to the main shore (the nest being on an Island in a river). Shortly after the Indian got ashore, he met his Father and lived with him for a long time. Whilst he was hunting Beaver one day, an Eagle carried him off again and brought him to his former friends, the young Eagles, who on seeing him said, "We must not kill this fellow, having saved his life once already". The Indian then took it into his head to destroy the Eagles, and accordingly set fire to the nest.

Here ends the story of the man who married the mouse.

CHAPTER IV.

THE MAN WHO DREAMT OF THE BUFFALO.

There was a certain Indian who used to dream about Buffalo, and finally found himself among them. In the Winter he and other Indians used to travel about. One day this man was sitting at the bottom of a rock when a buffalo brought him in its mouth a piece of fat, and told him to take it to his father. He brought it to his father, who was with the other Indians. Then they all made snares to kill the buffalo, and when chasing them into the snares, he of the dreams got transformed into a buffalo, and said to his father and friends, "When you see a male buffalo do not kill him because that will be me". This buffalo Indian after that always used to decoy the buffalo to where the Indians had snares. When the next summer came he left the buffalo country and went back to his people, and became a natural Indian again.

Here ends the story of the Indian who dreamt of the Buffalo.

CHAPTER V.

A big Indian once lived upon the earth, and very probably was the same man who burnt the Eagles, only he had increased to a great size.

He told his son-in-law to get some Beaver for him, so the young man started out and soon came to a Beaver house; there were some partridges about so he did not touch the Beaver house, but passed on, and soon met the big Indian. The Beaver seem to have followed him from the house, for they arrived just after him at the same place.

The "Big Indian" was asleep, but very soon awoke after the Beaver came. He took a stick off the fire, and killed them all with it; after this he roused his son-in-law, who was in the same camp with him, and told him to go to another "Big Indian" who lived some distance away.

He went for this giant as he was told: on his return, as he was nearing his father-in-law's tent he called out to him that the "Big Indian" was coming; he then turned off the track, and let the "Big Indian" go to the camp alone. Shortly after this the son-in-law heard the two big Indians fighting above him, as he thought, in the sky.

Big Indian No. 1 said to his son-in-law, "They are going to throw me down; you take the axe and cut the sinew in the other Big Indian's leg".

Big Indian No 2, after having his sinew cut, was easily overcome by his foe, and was thrown down, and his fall made the earth shake as by an earthquake. He fell on a sheet of water, but his body was so large that the place where he fell became dry land across the lake.

This story is not complete, the rest is forgotten.

CHAPTER VI.

This is about an Indian, his wife, and two children. They were really animals, but resembled the Indians of to-day.

One day they were breaking into a Beaver house, when the wife took it into her head to leave her husband. When he found that she had really run away he went in pursuit. The woman soon came to a family of ants (those that live in rotten sticks) and took one of them for a husband. The woman's first husband came up, chopped the stick the ants lived in, and killed the ant that his wife had taken for a second husband.

The woman and her first husband then had a fight, and killed each other. Their two children, who were boys, took up their parent's axe (made of Beaver teeth), Indian awl, and fire steel, and started out to seek their fortune. When their Father and Mother killed each other, her head had been taken off, but having had an ant for her second husband, she was able to come to life again. After coming to life she went in search of her boys. As the boys fled their Mother's head pursued them in the track.

Before their Father died he told them that as they were running away they should throw down at intervals their comb, fire-steel, and awl, and that nobody would be able to overtake them. The biggest of

the boys had to carry his brother; he soon got warm and swinging the axe which he held in his hand, he threw it out before him, by accident. A creek immediately formed where the Beaver teeth axe fell, and the boys could not get across, so they sat down to think. They had not been there long when a large white bird—larger than a Swan—came to them (the Chipewyans call this bird "Whadatsha", they are yet to be found on their hunting grounds; the bird has a large crop in his breast, like a Ptarmigan). This bird appears to have been the Father of the two boys, who was transformed after death. The bird took up the boys and flew across the River with them. After he had put the children across, the woman's head came to the river, and asked him to take her across, so he took up the head, and when half way across dropped it into the River. After the head fell into the water he watched it drifting along, and at last saw it disappear in the shape of a Sturgeon. The white bird gave the smaller of the boys, who was crying, one of his quills to pacify him.

The boys again went on their journey and came to the seacoast; when they got there, the Devil (a bad spirit "Beshtinly") came to them in a canoe. "That is a fine Gull you have", said Beshtine, "give him to me"; and at the same time, saying it was too far for the boy to step to the canoe, put his paddle so that the boy could walk on it. When he had stepped on to the paddle, Beshtine threw him into the canoe, and left the other boy standing on the beach. Beshtine then went away. The boy who was left began to cry, and at last turned to and howled like a wolf. He called to his brother, who was in Beshtine's canoe and said, "I am now a wolf". Beshtine had a daughter, and when he reached her tent, he said, "I have brought you a husband, go and bring him", for he had left the young fellow in the canoe. After the girl had seen the boy, she thought he looked so strange that she went back to her Father without him. Beshtine sent her again for the boy, and said, "He has been crying in the canoe, and that is why he appears so ugly to you". The girl then went and brought the boy to the tent.

After he had been washed, she combed his hair, dressed him and gave him something to eat. After he had grown to be a man, he thought, "If there was some birch here I would make some bows and arrows". Beshtine asked his daughter what he was saying, and when she told him, he said he would take the young fellow in his canoe to where there was some birch; this he did and left him there. Beshtine then returned to his tent. When the young man had made his bows and arrows he was turned into the shape of a Gull, and flew back to the tent. He then wished to have some quills to put on his arrows, so his old Father-in-law, Beshtine, took him to an Eagle's nest across the

River, and left him there. The Gull-man asked the young Eagles to show him their quills, which he found to be rather short. He then asked the young birds to show him the stream from which the old Eagles drank. He next got some Porcupine quills, and put them into the water. When the Eagles came to drink, as they had so often done before, they did not notice that anything had been put into the water. They were both choked by the quills. The young man, for he had again been transformed to that shape, took the quills of the Eagles and put them on his arrows.

Beshtine then went for him, and took him to the tent in his canoe. The young man took it into his head to kill Beshtine, also the old wife and her daughter, so he poisoned them all. Sometime after this he turned into a black Wavie, thereby becoming brother to all the animals. He now began to be hungry, and spoke to the weeds that grow on the rocks, saying, "If I eat you what will be the consequence?" "You will be filled with wind," answered the weeds. Well, he ate some of them, and got very full of wind. He then made a fire on a rock, and got badly burnt in the region of the hips; after the scorching he felt as if drunk, and walked into a pond. Shortly after leaving the pond he came to what appeared to be a piece of dried meat, but was told by a small bird, it was the skin burnt off his own body; then the man-wavie broke the dried meat to pieces, and threw it on some birch trees; it then became touch-wood. This was the origin of touch-wood.

As he went on his way he met a black bear eating berries, and lived with the bear for a long time. He used to pick berries and let the bear eat them out of his hand. He wanted to get away from the bear's company, so he took a berry in each hand, and squeezed the juice into the bear's eyes; this was rather painful, and to comfort his companion he made him a sweating house; took him in and said, "Put your head on this stone"; the bear did so, and the man taking up another stone, smashed the bear's skull. When he had killed the bear his mind was at ease, and he thought he would make the acquaintance of a white crow; for this purpose he went up into a tree, but after he got up into the trees they pressed so close together that he was entangled in the branches, and was unable to move. The Whiskey Jacks seeing this began eating the bear, and would not give over, although the man was calling "My brother! that is my bear, leave him alone". When the Whiskey Jacks had eaten all the bear, the trees opened out and he was able to get down. He found nothing but the bones of the bear. He made a fire, broke the bones, and made grease of the marrow. When he had finished this he went farther on, and met some Muskrats whom he told to freeze the

grease as he was unable to do it himself. The rats took it into the water, and spilled it, so making an end of the grease. As he went on still farther he heard some wavies, and brought them a bundle of grass. "Now", he said to the wavies, "we shall have a feast." He built a place where the feast should be held, after which he took the wavies and entertained them with fresh grass, also playing the drum for their amusement. It was not very long before they all went to sleep, and when they were asleep the man took it into his head to kill them. He set to work and bit off the heads, as he thought, of all of them, but he was mistaken, for shortly afterwards one of the wavies woke up, and called to the others that the man was killing them. On hearing this sad news most of them got up and flew away, showing the man that he had killed very few.

The dead wavies he cached at once, and then walked along the bank of a river. It was not long before he met a Fox with a crippled leg. "Come, my brother", he said to the Fox; "I have a cache not far from here, we will go and have a feast." "But", said the Fox, "I am crippled, and would not be able to keep up with you." "Take the short cut then", said the man, showing him the way, "and I will go by the track." When they had parted it did not take the Fox long to reach the appointed place. He robbed the cache, and hid the contents in another place. He took the precaution to cut the feet off the wavies, and stuck them in the sand, so that when the Indian came he would see the feet, and think the cache untouched. "Hello", said the man when he came up. "I have beaten the Fox after all, I am before him." He then called out to the Fox, "My brother, come this way, the cache is here". The Fox was too busy just then having a quiet meal off one of the wavies, and would not come. The Indian thought he would have a wavie to eat in the meantime, so he caught hold of one of the legs to pull up the wavie, but instead of the body he only got a leg. "Ho", said he, "the sand has been so hot that they are too much cooked, and that is why the leg pulls from the body so easily." When he had further examined he found that the Fox had been too sharp for him.

CHIPEWYAN STORIES.

FROM SIR J. FRANKLIN'S "POLAR SEA, 1825-7".

THE first man was, according to the traditions of their fathers, named Chapewee. He found the world well stocked with food, and he created children to whom he gave two kinds of fruit, the black and the white; but forbade them to eat the black.

Having thus issued his commands for the guidance of his family, he took leave of them for a time, and made a long excursion for the purpose of conducting the sun to the world. During this his first absence, his children were obedient and ate only the white fruit, but they consumed it all; the consequence was that when he a second time absented himself to bring the moon, and they longed for fruit, they forgot the orders of their father and ate of the black fruit, which was the only kind remaining. He was much displeased on his return, and told them that in future the earth would produce bad fruits, and that they would be tormented by sickness and death; penalties which attach to his descendants up to the present.

Chapewee himself lived so long that his throat was worn out, and he could no longer enjoy life; but was unable to die until at his own request one of his own people drove a beaver tooth into him.

The same—or another Chapewee, for there is some uncertainty on this head—lived with his family on a strait between two seas. Having there constructed a weir to catch fish, such a quantity were taken that the strait was choked up, and the water rose and overflowed the earth. Chapewee embarked with his family in a canoe, taking with him all manner of birds and beasts. The water covered the earth for many days, but at length Chapewee said, "We cannot live always thus, we must find land again", and he accordingly sent a beaver to search for it; the beaver was drowned and his carcase was seen floating on the water; then Chapewee dispatched a muskrat on the same errand.

The second messenger was long absent, and when he returned was nearly dying with fatigue, but he had a little earth in his paws. The sight of the earth rejoiced Chapewee, but his first care was about the safety of his faithful servant the rat, which he rubbed gently with his hands, and cherished in his bosom until it revived. He next took up the earth and moulded it with his fingers and placed it in the water where it

increased by degrees until it formed an Island in the ocean. A wolf was the first animal Chapewee placed on the infant earth, but the weight proving too much, it began to sink on one side, and was in danger of turning over. To prevent this accident the wolf was directed to move round the Island, which he did for a whole year, and in that time the earth increased so much in size that all on board the canoe were able to embark on it. Chapewee on landing stuck up a piece of wood which became a tree and grew with amazing rapidity, until its top reached the skies.

A squirrel ran up this tree and was pursued by Chapewee, who endeavoured to knock it down with a stick, but could not overtake it. He continued the chase, however, until he reached the stars, where he found a fine plain and a beaten road; in this road he set a snare made of his sister's hair, and then returned to the earth.

The sun appeared as usual in the heavens in the morning, but at noon it was caught by the snare which Chapewee had set for the squirrel and the sky was instantly darkened. Chapewee's family upon this said to him, "You must have done something wrong when you left aloft, for we no longer enjoy the light of day". "I have", replied he, "but it was unintentional." Chapewee then endeavoured to repair the fault he had committed and sent a number of animals up the tree to release the sun by cutting the snare, but the intense heat of the sun reduced them all to ashes.

The effort of the more active animals being thus frustrated, a ground mole, though such a grovelling and awkward beast, succeeded in burrowing under the road to the sky, until it reached and cut asunder the snare that bound the sun. It lost its eyes, however, the instant it thrust its head into the light, and its nose and teeth have ever since been brown as if burnt.

Chapewee's Island during these transactions increased to the present size of the American continent, and he traced the course of the rivers and scraped the lakes by drawing his fingers through the earth. He next allotted to the quadrupeds, birds and fishes their several stations, and endowed them with certain capacities. He told them that in future they were to provide for their own safety, because man would destroy them whenever he found their tracks; but to console them, he said that when they died they should be like the seed of grass which, when thrown into the water, springs again into life.

The animals objected to this arrangement, and said, "Let us when we die be as stone, which when thrown into a lake disappears for ever from the sight of man". Chapewee's family complained of death being

entailed upon them for eating the black fruit, on which he granted that such of them as dreamed certain dreams, should be men of medicine, capable of curing disease and of prolonging life. In order to preserve this virtue, they were not to tell their dreams until certain periods had elapsed. To acquire the power of foretelling events they were to take an ant alive and insert it under the skin of the palm of the hand, without letting any one know what they had done.

For a long time Chapewee's family were united as one family, but at length some young men being accidentally killed in a game, a quarrel ensued, and a general dispersion of mankind took place. One Indian fixed his residence on the borders of the lake, taking with him a dog, big with young. The pups were in due time littered, and the Indian when he went out to fish carefully tied them up, to prevent their straying. Several times as he approached his tent, he heard a noise of children talking and playing, but on entering it he only perceived the pups tied up as usual. His curiosity being excited by the noises he heard, he determined to watch, and one day, pretending to go out and fish according to his custom, he concealed himself in a convenient place. In a short time he again heard voices, and rushing suddenly into the tent beheld some beautiful children sporting and laughing with the dog-skins by their side. He threw the dog-skins into the fire, and the children, retaining their proper forms, grew up and were the ancestors of the Dog Rib nation.

THE MORAINE SYSTEMS OF SOUTHWESTERN ONTARIO.*

BY FRANK B. TAYLOR.

(*Read 26th April, 1913.*)

INTRODUCTORY.

AT its maximum extent the front of the Wisconsin ice sheet reached nearly to Cincinnati, Ohio, and covered completely the whole province of Ontario. It is now well known that the movement of the ice sheet from its centres of growth in the North was due to the force of gravity acting upon a mass of ice so vast and piled up to so great a height that it had at all times a continuous surface slope descending from its centre to its edge. This surface slope was the fundamental condition of its movement. Its motion was a slow, semi-viscous, flowing movement in which the ice, like water, was always seeking a lower level. To a certain extent, but imperfectly, it obeyed the laws of hydrostatics. The fact that it filled the Great Lake basins, completely overflowed the highlands between them and even overtopped mountain peaks, like the Catskills, the Adirondacks and the White mountains, shows the enormous thickness which the ice must have had in Labrador in order to have had a descending surface slope that would pass over the tops of such mountains as Mt. Washington in the White mountains and Mt. Marcy in the Adirondacks. On the basis of such facts it has been estimated that at its maximum the ice at its centre in Labrador must have been at least 13,000 feet thick and may have attained a thickness of 15,000 or 20,000 feet. Fragments of Potsdam sandstone were carried from low levels near the north end of Lake Champlain to the tops of the Adirondacks. The possibility of the performance of such feats by the ice used to be strenuously denied. But knowing the nature of glacial movement and the enormous thickness of the ice, it is easy to see that detritus could be carried up hill to or over the top of any object—any hill or mountain—over which the ice mass was moving.

Since the ice was plastic and moved under the action of gravity, it was influenced largely by the topography of the land over which it moved. Thus, at its maximum the Wisconsin ice sheet reached nearly to Cincinnati, but in western New York reached only to Salamanca. But Salamanca is on the Alleghany plateau near its front and stands high above the lake basins to the north. The front of the plateau extends southwest along the south side of Lake Erie to the vicinity of Cleveland, Ohio. This great bulwark of the land guided the movement of the ice toward the southwest and caused it to overspread the lower plains of

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western Ohio and Indiana. The ice stream which flowed westward and southwestward through the basins of Lakes Ontario and Erie was one of the greatest currents of the ice sheet. The southwestern peninsula of Ontario lay between this stream and another like it which crossed Georgian Bay and moved southward through the basin of Lake Huron, turning toward the southwest to join with the Ontario-Erie stream in northwestern Ohio. The culminating point of the highlands forms the promontory or "mountain" west of Collingwood. This highland obstructed the flow of the ice and was overflowed by it for a relatively brief time, as compared with the lower lands around it. This is why ice lobes projected forward from the mean line of the ice front in the lake basins and re-entrants reached back from that line on the highlands. The larger elements of relief gave the ice front its lobate form.

THE MANNER OF THE GLACIAL RETREAT.

One of the peculiarities which characterised the retreat of the Wisconsin ice sheet was the oscillation of its front or edge. During the time of its general retreat its front did not retreat evenly nor at a uniform rate, but by alternating and recurring steps of advance and retreat, in which the backward steps were always longer than the forward steps. It was as though the retreating ice front underwent continual oscillations in which it took two steps backward and one forward over and over again, the result being that, on the whole, the front of the ice retreated in a northerly direction. These are known as the stadial oscillations of the ice front. Other oscillations subordinate to the stadial oscillations are known as minor oscillations.

The amplitude of the stadial oscillations, by which is meant the distance or space over which the ice front retreated and readvanced in each complete oscillation, varied considerably under different conditions and has been determined with only approximate accuracy in a few cases. We know that in one instance at least the retreat was not less than 30 or 40 miles and may have been much more, and that even if the retreat was only 30 miles, the readvance was not less than 20 or 25 miles. This was on the "thumb" of Michigan, where the ice front had stood a little farther south than the Port Huron moraine, and its next step of retreat carried the front back northward from the "thumb" far enough to open a relatively wide passage between Saginaw Bay and the south part of Lake Huron. Just before this time the ice front rested at such an altitude on the "thumb" that the lake waters in the basin of Lake Erie were held up to an altitude about 80 feet higher, for the lake level fell this much in consequence of this step of retreat and the passage opened

around the north side of the "thumb" was wide enough to allow heavy storm waves to make strong beach ridges. Then when the ice readvanced it closed this passage and pushed up on to the "thumb" far enough to raise the lake waters about 45 feet. At the climax of this readvance the ice front rested for a relatively long time on nearly the same line and it was during this time that the Port Huron moraine was built. Not that the ice itself was stationary, for it was not. The ice was always moving slowly forward, but it was also melting. The melting of the ice always tended to drive the front back and it was only when the rate of melting exactly balanced the rate at which the ice advanced that the front became, as we say, stationary. At these times the ice front paused or halted, though the ice itself kept moving, and it was only during these times that terminal or marginal moraines were built. Whether the ice front at any given time or place retreated or advanced or stood in a stationary state depended upon the ratio between melting and the forward movement of the ice. If melting did not take place there was no loss of ice and the front advanced; if melting took place faster than the ice advanced, then more ice was lost in a given time than came forward and the front retreated.

Whenever the ice front halted a marginal deposit of some kind was made, for the ice nearly always carried in its lower layers more or less dirt or detritus gathered from the surface of the ground or of the rock over which it moved. This detritus comprised all grades of coarse and fine rocky materials, and they were mixed promiscuously together. Since a moraine of some kind was always made when the ice front halted for any length of time, we are compelled to believe that moraines were built at halts following movements of retreat as well as at those following movements of advance. But the moraines formed at climaxes of retreat were always overridden and obliterated at the next advance. From this fact it follows that the moraines which we see and study were made at successive climaxes of readvance during a general movement of retreat. This record of the glacial retreat furnishes by far the greater part of the material available for the study of the manner of glacial movements and for the study of the origin of the drift forms which make up the greater part of the surface. Southwestern Ontario is covered with a series of these terminal moraines, all made at climaxes of readvance during the general recession. That some movements of retreat and advance covered more distance than others and were more important in their significance is not to be doubted, but only one or two distinctions of this kind have been made at the present time.

The outline of the ice front changed greatly with the progress of retreat. At first the whole region was covered and there were no lakes in

this part of Ontario. Then the Erie and Huron ice lobes became separated in the region northeast of London, though still united toward the southwest. Soon the two lobes parted and were sharply defined, until the ice had melted far back in each of the basins. Up to this time the ice in the basin of Lake Ontario had not become differentiated into a separate lobe, but was simply the basal part of the Erie lobe, and the same was true of the Georgian Bay-Lake Simcoe ice mass. But when it had retreated nearly to Buffalo the ice in the basin of Lake Ontario began to take shape as a sharply defined lobe. It not only ceased to occupy any part of the basin of Lake Erie, but it became sharply separated from the ice to the north of it in the basins of Lake Simcoe and the Trent valley, the line of division being along the high ridge of land—the Oak Ridges—north of Lake Ontario. By the shrinking of the Lake Huron lobe and its separation from the Lake Ontario lobe, the ice mass in the basins of Georgian Bay and Lake Simcoe and the Trent valley became a separate lobate mass. It was blunt in shape and less pronounced in its lobate form, but it took on a system of movements of its own which clearly make it a separate lobe in this stage of the retreat.

MAP SHOWING DISTRIBUTION OF MORAINES.

The accompanying map, in colours, shows the present state of knowledge concerning the terminal moraines of this part of Ontario. All the moraines represented, excepting the two small fragments shown northeast of Lake Simcoe, were studied and mapped by the writer. Parts of these beyond the border of the map were studied by the writer in 1907. The parts shown were mapped by W. A. Johnston of the Canadian Geological Survey and his assistants. Some of the moraines are shown extending across the border into Michigan and New York. These were also mapped by the writer, excepting parts of some of those east and south of Buffalo. Those in Michigan and New York are put upon the map in order to show the continuity of the individual moraines beyond the boundary, and especially in order to make more clear the symmetrical relations of the moraines to the lake basins. The area in Ontario is a large one, covering approximately 30,000 square miles, and the moraines shown are a part of the results of numerous field excursions beginning in the summer of 1893. The mapping is still far from complete; some of the moraines are known as yet only in fragments and the relations of some are not yet worked out. But enough has been done to show the system of the moraines and their relations to the several ice lobes. Some parts of the region have not yet been studied and the completion of the mapping awaits the exploration of those parts. The map-

ping done is also quite uneven in degree of detail; in some parts, especially the northwest, the work was mainly of the nature of reconnaissance and was done early in the studies. Other parts, as the moraines on the Niagara peninsula, those along the escarpment southward from Collingwood, and those north of London and north of Toronto were studied in much more detail. This was the natural result of work carried on through many years on an independent basis. Since 1908 the work has been done under the direction of the Director of the Geological Survey of Canada.

THE UNCOVERING OF "ONTARIO ISLAND".

One of the results of the influence of topography upon the movements of the ice was the formation of what may be called "Ontario Island". At its maximum the ice was probably not less than 2,000 or 3,000 feet deep over the region around Dundalk on the top of the highland south of Collingwood. But as the ice melted off, this covering grew thinner, until at last it became so thin that it ceased to move. Streams melted out tunnels and canyons in it and reached down into the dirty basal layers of the ice. From these the streams gathered gravel and sand, and where they filled the tunnels and canyons with this material they made eskers, like the magnificent ones which extend southeast from Flesherton and Mount Forest, or, where they dumped their load in an expanded cavity or recess in the ice they made kames, as in the great hills of gravel and sand northeast of Stratford and north of Barrie. But soon this thin ice covering melted off and a large area extending northeast from London was freed of ice, but was still surrounded by ice on every side.

During the warm season each year the ice sheet was affected by melting, not alone along its edge, but over a marginal belt several hundreds of miles wide. It is to be remembered also that great ice streams like those which flowed past this island are always hundreds of feet higher along the line of their central axes than at their sides. On this account, an extensive high obstruction in the path of the ice sheet, but over which the ice moved, always caused a depression in the surface of the ice sheet, and where the obstruction was so great as the highland between Lake Ontario and Lake Huron, it formed a correspondingly large depression. The surface of the ice sheet for 50 to 100 miles all around sloped toward this depression, and all the water from the melting on these slopes flowed into it. It is manifest that there was no chance for an outlet for this water anywhere north of London. But along a

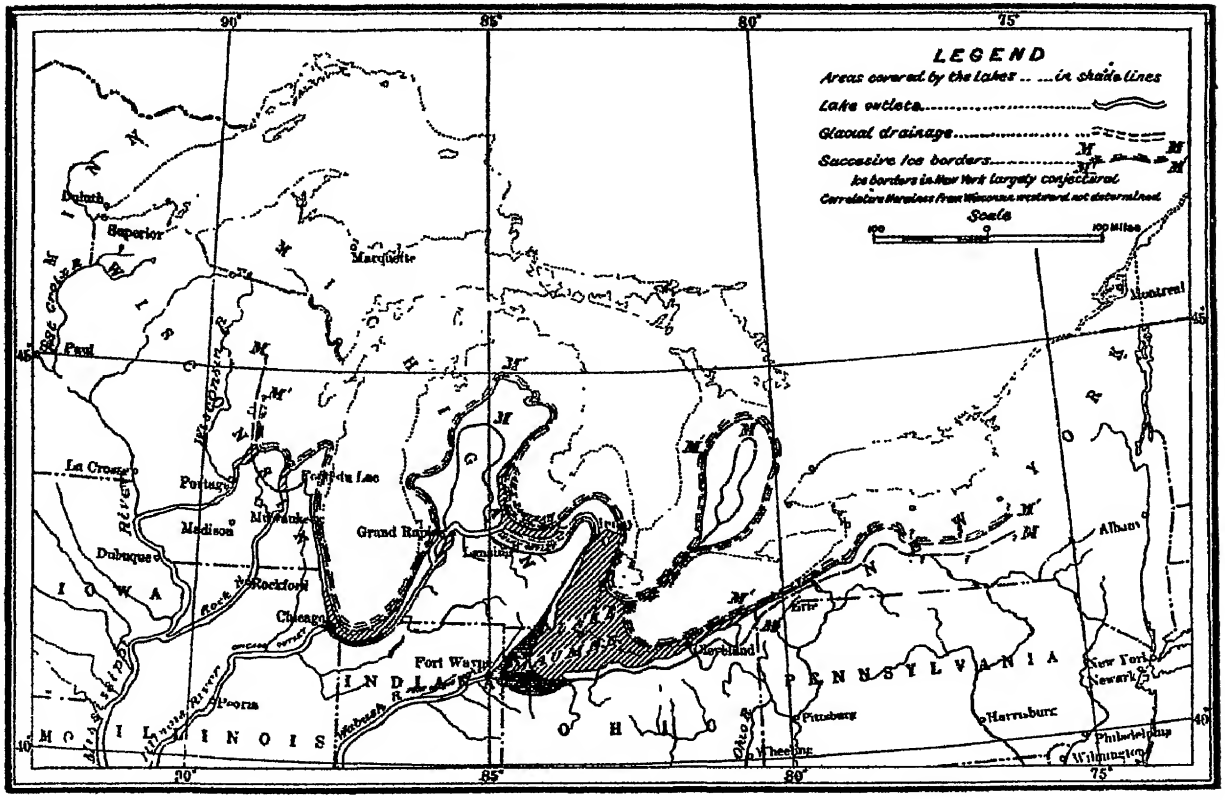


Fig. 1. Two stages of Glacial Lake Maumee: the first stage of "Ontario Island" is marked M, and a later stage M'; both stages entirely surrounded by ice.

line running southwest from London the ice of the Huron and Erie lobes met head on. This produced a dead line in the ice and a trough or crease in its surface. This crease led southwest from London to the edge of the ice sheet and was the only possible way of escape for the water that flowed into the depression of "Ontario Island". Judged by its hydrographic basin, that river, which we may call the "Crease River", should have been a river of large size. It was the glacial precursor of the modern Thames River.

There are several interesting facts bearing upon the existence of this glacial river beyond the boundaries of Ontario. The details cannot be given here, but it may be said that a great river issued from the ice sheet in central Indiana at and for some time after the maximum of the ice. This river came abruptly from the ice and carried no sediment. Remembering that the depression in the surface of the ice sheet existed over "Ontario Island" before the island itself was uncovered, it is evident that the "Crease River" at that stage encountered no dirty ice and gathered no sediment. It issued at the ice front as clear water. When the ice front had retreated to a position marked by a moraine which passes through Defiance, Ohio, a river issued from the ice which brought an immense quantity of sand, enough to cover the greater part of Fulton county, Ohio. No earlier deposit of this kind is known, and it is believed that the deposit mentioned marks that time when the Crease River first encountered dirty ice; that is, when the kames northeast of Stratford were made, which was just before the uncovering of "Ontario Island". At this time there was probably a continuous narrow trough and a gradual descent from Stratford to Fulton county, Ohio. A little later, when the island was first uncovered, its surface near London was probably covered by a shallow, temporary lake which stopped the escape of sediment, and the ice lobes soon after pulled apart so as to let the water of glacial Lake Maumee nearly up to London, and then the gravels were deposited in it, as may be seen in the great gravel beds near Komoka, a few miles west of London. Curiously enough, in the uncovering of "Ontario Island" the first part to appear above the ice was not the highest part of the highland, which is located not far from the village of Dundalk, but was a long, flat area extending from the city of London at least 60 or 70 miles toward the northeast with a width of 10 to 20 miles. This area formed a low-lying flat island in the midst of the ice field and was more than 100 miles from the nearest part of the mainland.

With continued recession of the ice, the front drew back on all sides enlarging the area of the island. But the separation of the two lobes did not increase the land surface southwest of London, because glacial

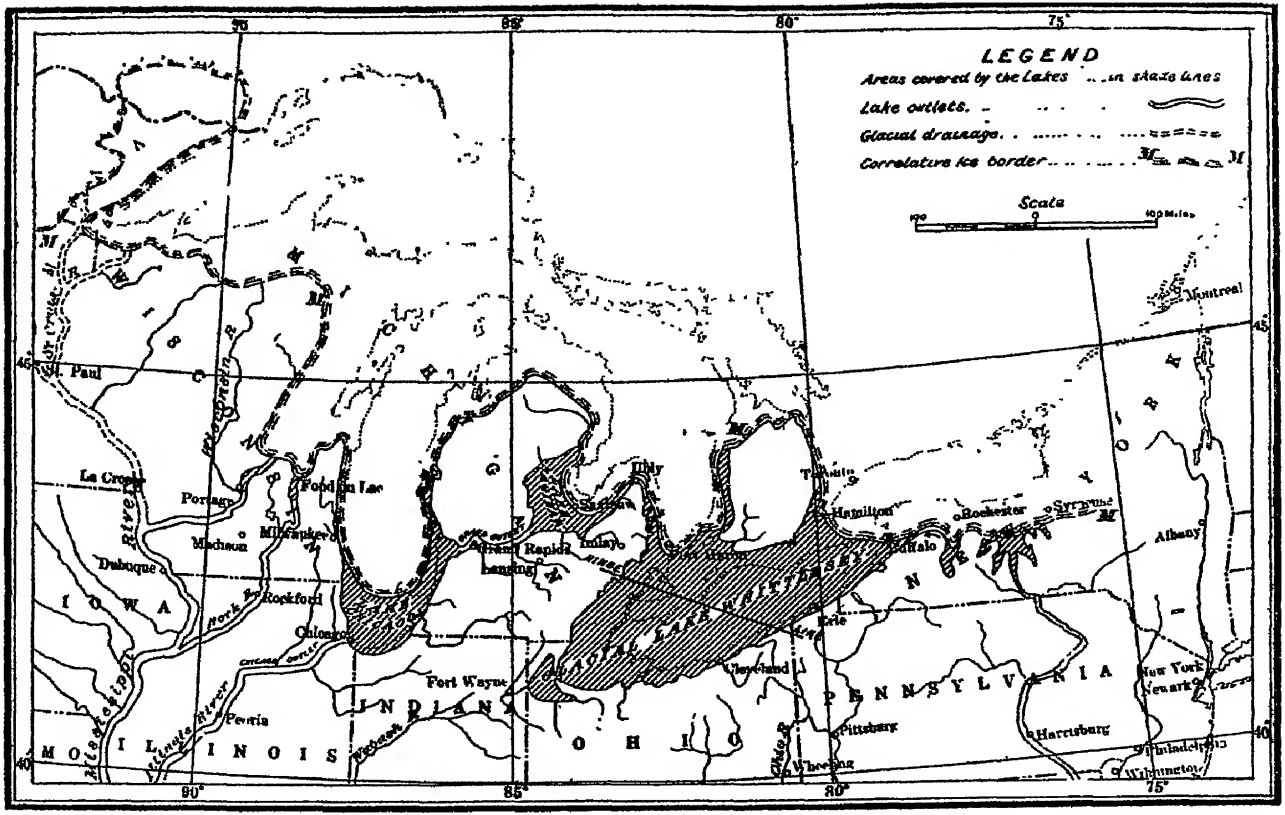


Fig. 2. Glacial Lake Whittlesey, showing a later stage of "Ontario Island" in which the ice barrier formed less than half of its boundary.

lake waters occupied the area as soon as the ice withdrew. This left the island still bounded by ice on all sides, excepting a small part at the southwest end which had a shore of lake water instead of ice.

In a general way, this condition continued for a relatively long time. The central part of the peninsula was still an island in the true sense, until late in the glacial recession. After a time, however, it came to have a longer shore of water than of ice, but it did not expand so as to be separated from the adjacent mainland only by the narrow waterways of the St. Clair, Detroit and Niagara rivers until quite late in the glacial recession. As the ice front withdrew the island expanded both by the melting back of the ice and by the falling of the lake waters to lower levels. The progress of this expansion will be noted below as the successive steps of retreat marked by the moraines are described.

On the accompanying map most of the moraines have been given names, generally the names of towns through or near which they pass. Fragments are also named, where they are of any length. The names are applied merely as a matter of convenience in description, and while those of the longer moraines may perhaps stand permanently, the names of some of the fragments will probably be only temporary, for future studies in the field will no doubt show that they are not independent moraines, but are parts of one individual. In such cases the names will have to be revised at some later time.

MORAINES OF THE LAKE HURON ICE LOBE.

The moraines formed along the east side of the Lake Huron ice lobe have not been fully investigated, especially in the flat, low region southwest of London, where they become faint, waterlaid forms, but nine or ten moraines belonging to this group have been mapped.

1. *The Essex Moraine.*—This moraine, known as the Detroit moraine in Michigan, extends from Detroit southeastward through Essex to the high knoll west of Leamington. Its relation to the ice lobes has not yet been clearly worked out. In Michigan its descent down the slope from Birmingham to Detroit transverse to the valley axis suggested an interlobate origin, but the part in Ontario seems more like a moraine of the Lake Huron ice lobe. If it was interlobate in origin it was subglacial, but if it was a simple, terminal deposit it was laid down in about 200 feet of water. This moraine is a low, broad ridge of till, very smooth and with such gentle side slopes as to be quite inconspicuous to the eye as a ridge. It has, nevertheless, a relief above the flat lake plains around it of 12 to 15 feet. At present the relation of this moraine to the others farther north and belonging to the Lake Huron lobe is not known. The intervening area has not been studied.

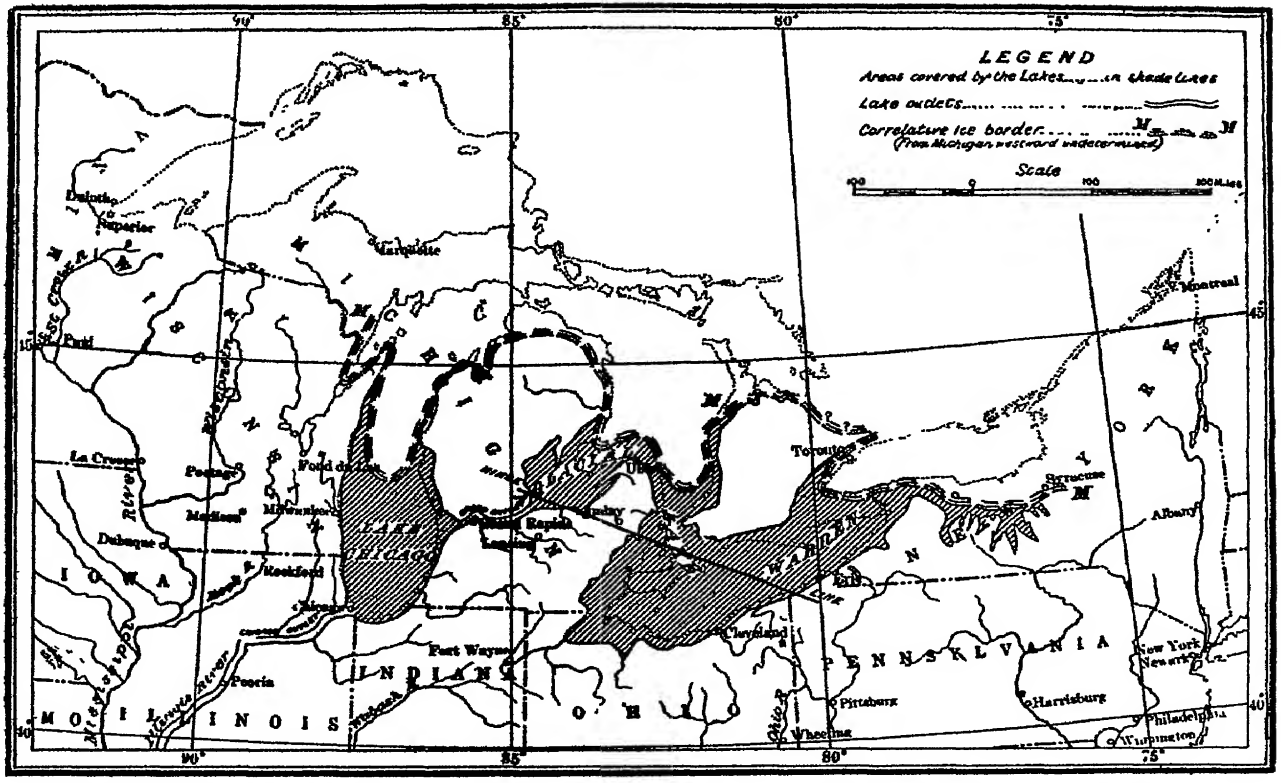


Fig. 3. Glacial Lake Warren, showing a later enlargement of "Ontario Island", when the ice barrier formed only a small part of its boundary.

2. *The Milverton Moraine.*—This moraine runs on an irregular course north-northeast from London and has been followed to a point five miles northeast of Mount Forest. It is a slender, lightly built moraine, rather narrow but quite well defined, its relief being generally 20 to 30 feet, sometimes 50 feet. It was deposited on land and had a temporary glacial river flowing along its front for a considerable part of its length. This moraine marked the western boundary of "Ontario Island" in the first stage of its existence. The ice front probably retreated to a position a little farther west before readvancing to this moraine.

3. *The Mitchell Moraine.*—This is another moraine of the same slender type and strength and was formed at the next halt after the Milverton. Only a fragment of it is now known.

4. *The Lucan Moraine.*—This is a third moraine of the same slender type and was formed on a line only a little back of the Mitchell moraine. A fragment of the same length was traced and two or three smaller fragments farther north are believed to belong to it. The Milverton, Mitchell and Lucan moraines all grow faint towards the northeast where they pass up on to the higher part of the plateau. Their relations there have not been determined.

5. *The Seaforth Moraine.*—This moraine is somewhat stronger and more bulky than the three preceding it. It is generally slightly wider and higher than the others and the ice at the margin when it was being built was probably thicker than at the times of the earlier three, for this one appears to have been less sensitive to topography. A longer portion has been mapped but a gap remains north of Seaforth. Beyond this it is believed to find continuation in an equally strong moraine which passes through Clifford, Holstein and five miles east of Durham. Farther on it turns sharply to the east and passes through Ceylon and turns a sharp angle toward the southeast two miles west of Singhampton. The Seaforth moraine is strongly developed, especially toward the northeast from Mount Forest. It crosses the highest part of the highland south of Georgian Bay and some of its knolls may be the highest point of this part of Ontario, attaining an altitude of over 1,700 feet above sea level. The moraine itself is generally 50 to 80 feet higher than the plain in front of it and in some places reaches considerably more than 100 feet. It had a large river flowing along its front, beginning at the extreme northeast angle. South of Ceylon this stream had become quite large, and here and west of Mount Forest it filled a wide, shallow depression in front of the moraine with an extensive deposit of gravel and sand. South of Seaforth the same strong drainage line continues and its bed leads to the gravel deposits west of Komoka, to which this stream was probably the largest contributor.

These four moraines, not including the Essex, are all landlaid forms so far as mapped, but all become waterlaid in the old lake bed southwest of London. The same set of slender moraines occurs on the "thumb" and in the Saginaw valley in Michigan.

6. *The Clinton Moraine.*—As now known, this is a small fragment of moraine lying west and northwest of Clinton. It is strongly developed and stands high above the plain. It ends abruptly at the Bayfield river and farther south was overridden by the Wyoming moraine. It probably continues some distance northward, but has not been mapped.

7. *The Wyoming Moraine.*—This is one of the strongest moraines of the series and in its relations to the other moraines one of the most important. It is the continuation in Canada of the Port Huron moraine in Michigan. As was stated above, this moraine marks a readvance of the ice front after an exceptionally long step of retreat involving not only greater distance, but probably also a much greater time than for the average of the stadial oscillations. In Michigan and Wisconsin this moraine is distinctly out of accord with the moraines that preceded it. In Ontario its continuation in the Wyoming moraine stands in the same relation. The Clinton moraine is a fragment of an earlier moraine which has been overridden south of Bayfield river by the Wyoming moraine. On the "thumb" in Michigan the Port Huron moraine overrides the Arkona beaches in the valley of Black river northwest of Port Huron, and in Ontario, on the east limb of the same ice lobe, the same or Wyoming moraine overrides some parts of the same beaches between Arkona and Bayfield river. In both localities the Whittlesey beach is contemporary with this same moraine, but the Warren (Forest) beach is later and extends along the rear slope of the moraine.* About 7 miles west of Port Huron and 4 miles west of Wyoming this moraine becomes waterlaid and is low and inconspicuous in its relief. In this form it crosses the St. Clair river just north of St. Clair, Michigan, and Courtright, Ontario. Northeast of Wyoming to the Au Sable river it is stronger, but is wide and of rather low relief. Farther north it presents a bold, high front to the east along the west sides of the Au Sable and Maitland valleys. Beyond this it is strong and exercises a pronounced control over the drainage, especially on the courses of the Maitland and Rocky Saugeen rivers. Between Whitechurch and Berkely it has not yet been mapped in detail, but was seen near Walkerton and Hanover in early reconnaissances. It is narrower, but quite definite and strong north-

*A brief account of the glacial lakes, including Lakes Maumee, Arkona, Whittlesey, Warren, etc., may be found in the report of the Smithsonian Institution for 1912. More detailed descriptions will appear in a monograph of the U. S. Geological Survey, now in press.

west and northeast of Flesherton where there was a sharp lobe projecting south, and it turns sharp angles northeast and east of Gibraltar, the latter angle being located on the edge of the escarpment. A large river flowed southwest along its front and it was this stream that deposited around Flesherton the well known "Artemesia gravels" of Bell and other early writers. This stream entered an arm of glacial Lake Whittlesey west of Clinton.

8. *The Goderich Moraine.*—This moraine first appears on the top of the bluff south of Goderich and runs northeast to the brow of the promontory west of Collingwood. It is a strongly developed moraine and has much influence on the stream courses. It shows a sharper pointed lobe north of Flesherton and turns a sharp angle in two strands at Banks, on the top of the promontory.

9. *The Kincardine Moraine Strands.*—Near Kincardine five rather slender moraine ridges terminate on the bluff. They seem like deployed minor strands of a single moraine, but they have not yet been followed inland.

10. *The Port Elgin Moraine.*—This moraine begins on the bluff about 10 miles south of Port Elgin and runs northeast to Hepworth, where it turns towards the southeast around the valley of Owen Sound. It is a strong moraine and the north part is very bouldery. A small fragment probably belonging to this moraine lies three miles east of Owen Sound.

THE MORAINES OF THE LAKE ERIE ICE LOBE.

The possible relations of the Essex moraine have already been mentioned. The remainder of the moraines of the Erie lobe have not been much studied, excepting the last two in the eastern part of the basin.

1. *The Kingsville Bowlder Belt.*—A well marked boulder belt, with occasional very low, stony knolls of till, runs west through Kingsville and Harrow from the hill west of Leamington. It probably marks the course of a waterlaid moraine, but has not been fully worked out.

2. *The Blenheim Moraine.*—A well defined moraine passes just south of Taylor and Ridgetown and through Blenheim. Six miles southwest of Blenheim it is cut off abruptly at the lake shore, and from this point to Port Alma, a distance of about 10 miles, appears to have been entirely cut away by the modern lake. Running west from Port Alma and curving southwest to the knoll west of Leamington there is a low, flat ridge, hardly visible as a ridge, which seems to be its westward continuation. It is perhaps doubtful as yet whether this moraine may not be of inter-

lobate origin. Northeast of Blenheim it has a relief of 20 to 30 feet and is well defined. It passes to the north of the Michigan Central Railway a few miles east of Taylor.

3. *The St. Thomas Moraine.*—Another well defined moraine passes just south of Dutton and runs northeast through St. Thomas. To this point the moraines of the Erie lobe are all waterlaid, but a part of this moraine is probably landlaid.

4. *The Ingersoll Moraine.*—This moraine runs east from London along the south side of the Thames River and is in some parts a strong landlaid form. Small fragments of other moraines north and south of this one have been observed, but not yet traced any distance. The Ingersoll moraine is probably continued in the high ridge at Mount Elgin, six miles northwest of Tillsonburg.

5. *The Tillsonburg Moraine.*—This is a strong, high landlaid moraine, but only a small fragment of it is as yet known.

6. *The Waterloo Moraine.*—This is a finely formed moraine ridge running south from Waterloo to Ayr and west to Bamberg, but it has not been traced farther. It is higher and more bulky than the average.

7. *The Paris Moraine.*—This is one of the best known moraines in Ontario, having been traced with substantial continuity from the shore of Lake Erie southwest of Port Rowan to the brow of the escarpment south of Collingwood, where it is found to be the same as the Seaforth moraine of the Lake Huron slope. At or near Paris this moraine becomes waterlaid toward the south and grows steadily lower and fainter toward Lake Erie. It is still a sharply defined ridge at Scotland, but is weaker at Vanessa and is quite faint east of Delhi. Farther south it is scarcely perceptible as a ridge, but exerts some control over minor drainage. North of Paris it is landlaid and is strongly developed.

Inasmuch as the Ontario and Georgian Bay-Simcoe lobes had not yet become differentiated, this moraine may as well be described as one of the Erie group through its entire extent up to the angle south of Collingwood. The Paris moraine is unusually high southwest of Galt and it continues from Galt northeastward in strong development to a point near Acton. At Paris and Galt it is 25 to 30 miles west of the Niagara escarpment, but at Galt it trends more to the east and at Acton is less than 10 miles back. From Acton to a point 6 or 7 miles north of Orangeville it holds a place a few miles back of the escarpment, but for a number of miles beyond it is on or very near the escarpment. It is in this position west of Glen Cross and Mono Centre, east of Primrose, at Whitfield, east of Honeywood and at Maple Valley. But from Maple Valley to the angle west of Singhampton it lies some distance back. While it is strong all along, this moraine is truly magnificent in its de-

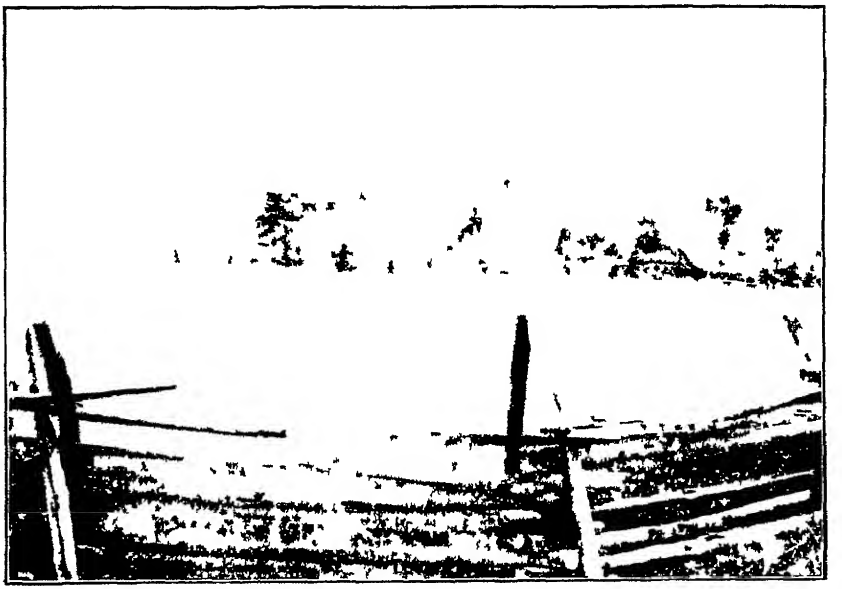


Fig 4 Front view of the Paris moraine near Guelph looking east

Fig 5 A section of boulder clay or till rather more stony than the average The moraines are built chiefly of this material

velopment from Orangeville to Singhampton. It is particularly fine east of Primrose and Honeywood, where it is over 100 feet in height. In both of these places it rises like a miniature mountain range, with steep, high front, and faces west over the nearly smooth plain of the highland which is a country entirely different from it in form and expression.

North of Credit Forks the course of this moraine is greatly influenced by the stream valleys that indent the escarpment. The ice barely overtopped the escarpment and gave full expression to these indentations in the sharp bends and angles of the moraine.

At this time there was, of course, a great gathering of water along the front of the ice and it formed a river of great size and increasing volume as it flowed away southward. Its headward parts have not all been worked out, but south of Orangeville its course is well marked, at first meandering among the drumlins of Erin and Eramosa. This stream flowed past the present sites of Guelph, Hespeler and Preston, and passing two or three miles west of Paris, emptied into one of the glacial lakes in the vicinity of Port Dover Junction. This Seaforth-Paris moraine furnishes the first complete ice boundary as yet established for "Ontario Island". At this stage the island had expanded to several times its original size, but was still bounded by ice along a line nearly eight times as long as the lake shore boundary across its south end. It was still nearly 100 miles to the nearest mainland.

8. *The Galt Moraine.*—This moraine is very closely linked with the Paris moraine. From Scotland, about 12 miles south of Paris, to Singhampton it is nowhere more than two or three miles back or east of the Paris moraine. This might be expected along the escarpment, where this moraine drops below its edge and vertical descent counted for as much or more than horizontal distance in retreat. But this relation continues from Credit Forks southward to Scotland where the moraines are 20 to 25 miles back of the escarpment.

The Galt moraine keeps its strength southward from Brantford to Simcoe and, indeed, is still a distinct ridge at Port Ryerse, where it is cut off at the lake shore. Between Galt and Eden Mills the two moraines are almost merged in one. From a point three miles southwest of Acton to Credit Forks the Galt moraine rests on the very edge of the escarpment and is quite fragmentary. Another moraine coming up from the south is set close behind the Galt moraine north of Credit Forks, and there are reasons for believing that this moraine overrides the Galt moraine at some point farther north. The studies of these lower moraines that skirt the escarpment is not yet complete, and while incomplete work seemed to show the Galt moraine extending to Gibraltar and finding its continuation in the Wyoming-Port Huron moraine of the Huron basin,

there are weighty reasons against this conclusion and which make it practically certain that it is not the Galt moraine but a later one that unites with the Wyoming moraine at Gibraltar. The reasons for this conclusion will be given in the discussion of the next moraine.

The moraines of the Lake Erie ice lobe described above have their correlatives on the south side of Lake Erie in a group of moraines which run along the face of the Alleghany escarpment. They have been mapped and described by Mr. Frank Leverett in U.S. Geological Survey Monograph XLI, 1902. Fragments of three moraines belonging to this series are shown on the map south of Buffalo—the Gowanda, Hamburg and Marilla moraines. These are probably correlatives of some of the moraines shown on the Canadian side, but their relations have not been fully determined.

The drainage associated with this moraine is even more remarkable than that related to the Paris moraine. Being below the escarpment most of the way from Singhampton to Credit Forks, the water was confined in a narrow valley. This valley was first aggraded or filled with gravel in several of its wider parts, only to be deeply trenched at a later stage by the same stream. The deep channel in the gravel filling east of Lavender illustrates this condition. East of Primrose and between Violet Hill and Mono Centre the same changes took place. One mile southeast of Granger the remains of a cataract about 75 feet high may be seen. During the first part of the time of this moraine the ice mounted too high on the salient of the escarpment east of Orangeville to let the water past, so it kept to the old channel past Orangeville to Cataract and Credit Forks.

At Credit Forks the glacial river found a lower passage than the old channel by running close along the edge of the ice where the latter rested on the edge of the escarpment, thus flowing in a bed the east bank of which was the ice itself. In this relation the river ran to a point three miles south of Acton and the result is that the Galt moraine is almost entirely washed away in this interval and the old river bed for nine miles lies on the edge of the escarpment with no bank on its east side, but a steep descent of 200 feet or more to the Credit River. South of Eden Mills the Paris and Galt moraines are merged together forming high ground and leaving no passage for the river, which on this account cut a valley 100 feet deep westward through the Paris moraine, emerging at Eden Mills, where it re-entered the older channel. This it followed to Preston, where it found an opening back through the Paris moraine to Galt, and went thence southward in the narrow valley between the two moraines and emptied into one of the glacial lakes below Scotland.

Some of the details relating to the drainage associated with the ice front at the time of the Paris and Galt moraines are given, because they show with absolute clearness the impervious nature of the ice sheet, that it was in effect a solid geological formation which served the purpose of controlling the associated waters as effectively as would a formation of solid rock. If the waters were running rivers it controlled the rivers; if the waters were lake waters it was capable of serving as a dam to hold them up to the level of the lowest point on their rim. The same ice mass which formed the bank of the river along the escarpment from Credit Forks to Acton spanned Lake Erie 100 miles farther south and formed a solid dam which held up the lake waters in the basin of Lake Erie to the level of an outlet in Michigan which carried them to the Mississippi River and the Gulf of Mexico.

THE MORAINES OF THE ONTARIO ICE LOBE.

When the ice retreated from the Galt moraine it appears to have withdrawn to an unusual distance, just as it did in Michigan before the building of the Port Huron moraine. No certain evidence of terminal morainic deposits have been found in the relatively wide interval between the Galt moraine at Simcoe and Waterford on the west and the first of the slender moraines east of Grand River.

1. *The Crystal Beach Moraine.*—This moraine starts at the shore of Lake Erie just east of Crystal Beach and runs west through Sherks and in broken form westward a mile or two from the shore to Lowbanks. West of this it is lost, first in swamps and further on in extensive deposits of sand. But it reappears northeast of Cayuga and is fairly distinct northwestward to a morainic complex which it enters west of Ancaster. This moraine and, indeed, the whole group on the Niagara peninsula are of the faint, slender type. They are narrow and their relief is often not over 10 to 15 feet, sometimes less. It is this weakness of development that makes them so hard to follow and so easily obscured or lost in sandy or swampy regions.

This moraine finds its continuation in New York in the Alden moraine which leaves the shore near West Seneca, south of Buffalo. At Alden, 20 miles east of Buffalo, it overrides the Arkona beach ridges in precisely the same way as the Port Huron moraine overrides them on the "thumb" in Michigan and as the Wyoming moraine overrides them in the Au Sable valley, south of Clinton, Ontario. This fact leaves no room for doubt that the Alden-Crystal Beach moraine of the Ontario ice lobe is the same as the Port Huron-Wyoming moraine of the Huron ice lobe. Not only is this moraine east

of Buffalo related in the same way as the Port Huron-Wyoming moraine to the Arkona beaches, but it is also related to the Whittlesey and Warren beaches in the same way as is the moraine in the Lake Huron basin. Thus, while the Wyoming moraine clearly extends up to Gibraltar on the highland, it is not continued southward along the escarpment in the Galt moraine, but in the Crystal Beach moraine, or in a bulkier moraine made up of a union of two or three of the slender moraines on the Niagara peninsula. Such a moraine extends from Copetown northward back of the escarpment nearly to Limehouse.

2. *The Fort Erie Moraine.*—This is the next of the slender group on the Niagara peninsula. It begins at Fort Erie, where it is well defined, and extends with one or two weak intervals past Welland to Binbrook, Glanford to the complex at Ancaster. It has the same weak development and in the middle part of the peninsula is extremely faint. It continues eastward in New York as the Buffalo moraine.

3. *The Niagara Falls Moraine.*—This moraine is extremely faint east of Chippawa, but to Niagara Falls and westward is distinct and fairly strong. It keeps its strength quite well westward past St. Ann, Smithville and Elfrida to Ancaster. Niagara River has cut deep embayments into it on the west side of the river at the Falls. This moraine is continued in New York in the Tonawanda moraine.

4. *The Vinemount Moraine.*—This moraine lies on the top of the escarpment and close to its edge throughout its whole course from the Brock monument above Queenston to Hamilton, and excepting in two or three short intervals is quite sharply defined with a relief of 15 to 35 or 40 feet. It is narrow and not bulky, but is clearly defined. Between St. David's station on the Grand Trunk Railway and Camden and again from Mount Albion west it sets back one or two miles from the escarpment, but elsewhere is much closer, generally less than half-a-mile back. This moraine is continued in New York in the Barre moraine, which continues on the brow of the escarpment to Lockport.

A later moraine, called the Albion moraine in New York, has not been surely identified west of Niagara River. A few knolls were found along the face or base of the escarpment that may belong to it, the most prominent ones lying between Bartonville and Stoney Creek.

All of these moraines are substantially horizontal in their courses across the Niagara peninsula, but they rise a little toward Ancaster. West of Ancaster the first three or four appear to combine into a single more bulky ridge and this, after making a sharp turn to the north around Copetown, runs northeast and north back of the escarpment to Lime-

Fig 6 Rolling topography on the top of a stron landlaid moraine

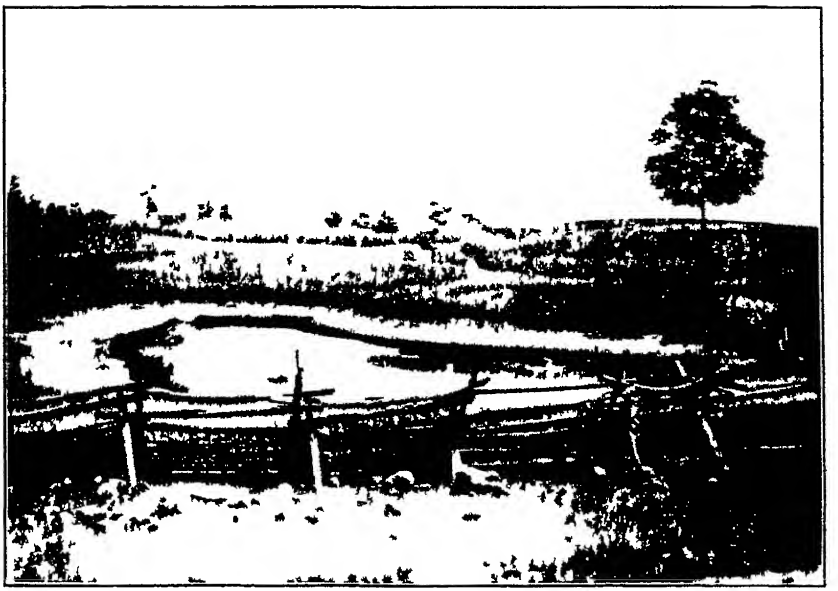


Fig 7 A pond in the Paris moraine west of Cheltenham

house. It seems probable that somewhere in this interval this moraine will be found to override the Arkona beaches just as at Alden, N.Y., and in the Lake Huron basin, but the critical ground has not yet been studied.

Northward from Copetown to the angle on the highland west of Collingwood the Crystal Beach moraine and whatever others are combined with it pass through a rough country, in part of which drainage along the edge of the ice prevented the building of moraines, while in the northern part the ice front rested against the steep face of the escarpment, a very unfavourable place for the deposition of terminal moraines and where such small, faint fragments as were deposited are exceedingly hard to identify. The course of the Crystal Beach moraine through this difficult region has not been fully determined.

Along the front of the ice in this position there was a large glacial river flowing south close to its edge from near Limehouse to a point 5 or 6 miles north of Copetown, where it entered lake waters and deposited a considerable quantity of gravel and sand.

On the north side of Lake Ontario the moraines are fewer in number and no certain correlation having yet been established, they are given separate names. The moraines on this side, excepting those already described, above the base of the escarpment, all turn eastward and join with moraines made by ice coming from the north out of the basin of Georgian Bay, Lake Simcoe and the Trent valley.

1. *The Palgrave Moraine.*—This is a short fragment extending south and east from Palgrave, and was made by ice moving toward the northwest. It is a strongly developed ridge with a rough, hilly surface. South of Mono Road it is overlapped by a later moraine and 6 or 7 miles east of Palgrave it unites with a moraine made by the southward moving ice of the Lake Simcoe ice lobe. It laps around the south side of Mt. Wolfe, which is a small till plain standing 150 feet or more higher than the moraine. During the building of this moraine a large river coming from the northwest flowed south along its front.

2. *The Cheltenham Moraine.*—This moraine begins about three miles north of Georgetown and extends north along the east side of Credit River, but from Mono Road it keeps a northeastward course through Castlederg and beyond this turns east and unites with the moraine of the ice from the north two or three miles west of Eversley. Its south part is smooth and low and seems clearly waterlaid, and it is less rugged throughout than the Palgrave moraine. One or two small fragments between Georgetown and Limehouse may belong to this moraine, and it probably continues southward along the escarpment. During the time of this moraine there was a large river flowing south along the front of the Palgrave and Cheltenham moraines. This stream occupied the

strongly marked old river bed between Tottenham and Georgetown and deposited the gravels upon which the latter town is built. It was the outlet of a temporary lake in the valley to the north. The lake was probably narrow, but extended a considerable distance to the north, for great delta terraces were built by the streams descending from the escarpment in quiet waters standing at the level of the head of this outlet northeast of Palgrave.

3. *The Bolton Moraine.*—This moraine begins at the base of the escarpment west of Milton and extends in a gradual curve past Georgetown and Bolton station and thence in more irregular form to King. It is waterlaid and quite faint in most parts. In all probability it follows the escarpment south to the Dundas valley, where it continues in some one of the moraines of the Niagara peninsula.

4. *The Oak Ridges Moraine.*—Southeast of King the Bolton moraine appears to unite with the higher landlaid deposit which extends to Maple and thence northeast past Bond Lake to the main high ridge which lies between Lake Ontario and the Trent valley. The deposits eastward from King and Maple are quite complex and their relations are not fully made out. The large, deep depressions or basins which lie along its central axis suggest that it is an interlobate deposit, the south half made by the Lake Ontario lobe partly overlapping the north half made earlier by the Simcoe lobe. South and west of Bond Lake the deposit has rather smooth slopes, but near Maple and around Bond Lake and eastward it is very rugged. Eastward from Willcocks Lake the broad, high and hilly ridge forms one of the strongest moraines in Ontario. To the vicinity of Burketon Junction it was built mainly by ice moving north out of the Lake Ontario basin. This is clearly established, for along the whole south side of the deposit from King and Maple eastward the ground moraine slopes up imperceptibly into the terminal moraine without any deposit of sandy or gravelly outwash On the other hand there are extensive outwash deposits along much of the north side, showing clearly that in this part the ice was facing north while the moraine was being built. Detailed studies have thus far been carried only about 5 miles east of the south end of Scugog Lake. Beyond that the general course of the ridge is well known, as shown upon the map, but the details remain to be studied.

5. *The Scarboro Moraine.*—This moraine begins at the base of the escarpment southwest of Ash and runs roughly parallel with the lake shore to Toronto. At Scarboro bluffs it rests on the edge of the high cliffs and is being cut away by the lake. From Scarboro it runs northeast in a nearly direct line to Claremont and thence eastward to a point 4 miles east of Columbus, which is as far as it has been studied. It is

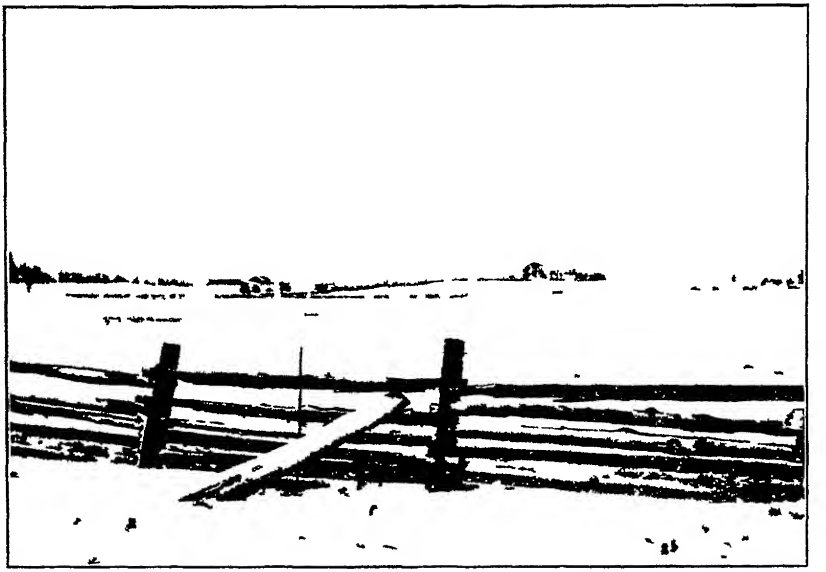


Fig 8 A distant view of the Scarboro moraine two miles northeast of Malvern looking south The houses are on the moraine ridge which is faint and of low relief because it was waterlaid

Fig 9 A glacial drainage channel west of Acton about half a mile wide and 100 feet deep

waterlaid throughout and is generally weak and faint, especially so between Streetsville and Toronto and from Claremont east. In the city of Toronto its course as indicated by the parts east and west of the city would lie along the Waldron ridge, which is the bluff extending from west to east through the northern part of the city a little south of St. Clair Avenue. But in this part no certain evidence of the moraine was found. This may be due to the heavy cutting on this part of the shore of Lake Iroquois, for the bluff of Waldron ridge was made by that cutting, which removed a considerable body of drift that once extended south from where the bluff now is. West of Toronto the ice front at this time had three sharply pointed tongues or lobes corresponding to the valleys of the Credit, Etobicoke and Humber rivers. This, with the obstructing rôle played by the high ground at Scarboro bluffs, shows the sensitiveness of the ice to topography. From its altitude and general relations there is much reason to believe that the Scarboro moraine is the correlative or continuation of the Albion moraine in New York. East of Lockport the Albion moraine lies at the front of the escarpment. Very little that might belong to it has been found farther west, but the Scarboro moraine holds the same relation to the escarpment southwest of Ash and all the moraines on the Niagara peninsula are substantially horizontal from east to west.

The space interval between the Bolton and Scarboro moraines is unusually wide for the series of the slender moraines. At several places, especially south of Milton, faint evidences of a moraine were found in this interval, but they seemed too faint and uncertain to put upon the map.

Two or three miles northeast of Port Nelson there are low till knolls which appear to be part of a terminal moraine. They are very bouldery and give the impression of having been severely washed down during submergence, which is probably the case, for they lie below the Iroquois beach. It seems probable that this fragment finds its correlative in the Carlton moraine in New York.

MORAINES OF THE GEORGIAN BAY-LAKE SIMCOE ICE LOBE.

The moraines along the escarpment have been discussed in connection with the Erie and Ontario ice lobes, and besides these there are at present very few morainic deposits to be discussed in connection with this lobe.

1. *The Owen Sound Moraine.*—Small fragments of a moraine lower than the Port Elgin moraine were found on the slopes east and west of the city of Owen Sound. They are well defined and very bouldery.

2. *The Hope Bay Moraine*.—A slender, but sharply defined moraine was found not far from the shore at Hope Bay on the Saugeen peninsula.

3. *The Linton Moraine*.—North of Palgrave there is a strong moraine which turns away to the northwest, but has not been followed in that direction more than 15 miles, so that its relations toward the north have not been determined. This same moraine, however, runs east around the north side of Mt. Wolfe and joins the Palgrave moraine. Farther east Linton is on its summit and commands a magnificent view both north and south. This moraine is stronger and stands at a higher level than the Palgrave moraine. One mile east of Linton a low gap through the moraine was probably the course of a large stream issuing from the Simcoe lobe. There is a deposit of sand along the north or rear side of this moraine from Linton to and beyond the gap north of Willcocks Lake. This deposit is not regarded as outwash, but as the work of a stream flowing westward between the ice and the moraine just before the final withdrawal of the ice. The gap at Willcocks Lake suggests a large stream coming through the moraine and flowing west past King. This may have been the case just before the ice readvanced to the Bolton moraine, but when the ice stood at the Bolton moraine, it pressed against the high spur west of Nobleton, and this must have cut off the escape of the waters toward the west. Eastward from Willcocks Lake to the vicinity of High Point the great volume of outwash along the north side of the moraine shows, as stated above, that the bulk of this ridge was built by ice moving towards the north from the basin of Lake Ontario. This is the Oak Ridges moraine described above. At the same time the front of the Simcoe ice lobe must have been close by, for there seems to have been strong drainage westward along the north side of the moraine from a point east of Ballantrae.

4. *The Uxbridge Moraine*.—At a time probably a little earlier than the Oak Ridges moraine the ice of the Trent valley pressed southward and built a set of strong, sharply defined morainic ridges running east-southeast one to three miles south of Uxbridge The remarkable thing about this moraine is that it is composed almost wholly, so far as seen of gravel. This gravel is not in the usual forms of glacial or glacio-fluvial origin, but is cast into the typical form of a terminal moraine. Evidently, the material which the ice gathered near by was almost wholly gravel, probably outwash of slightly earlier date. There are several strands of this gravelly moraine, all in parallel arrangement.

Between these ridges and extending west to a line running southwest from Vivian a great body of gravelly and sandy outwash covers the surface between the gravelly moraine ridges. Its depth varies, but

Fig. 10 A small drumlin channel cutting through the Paris moraine east of Guelph looking west

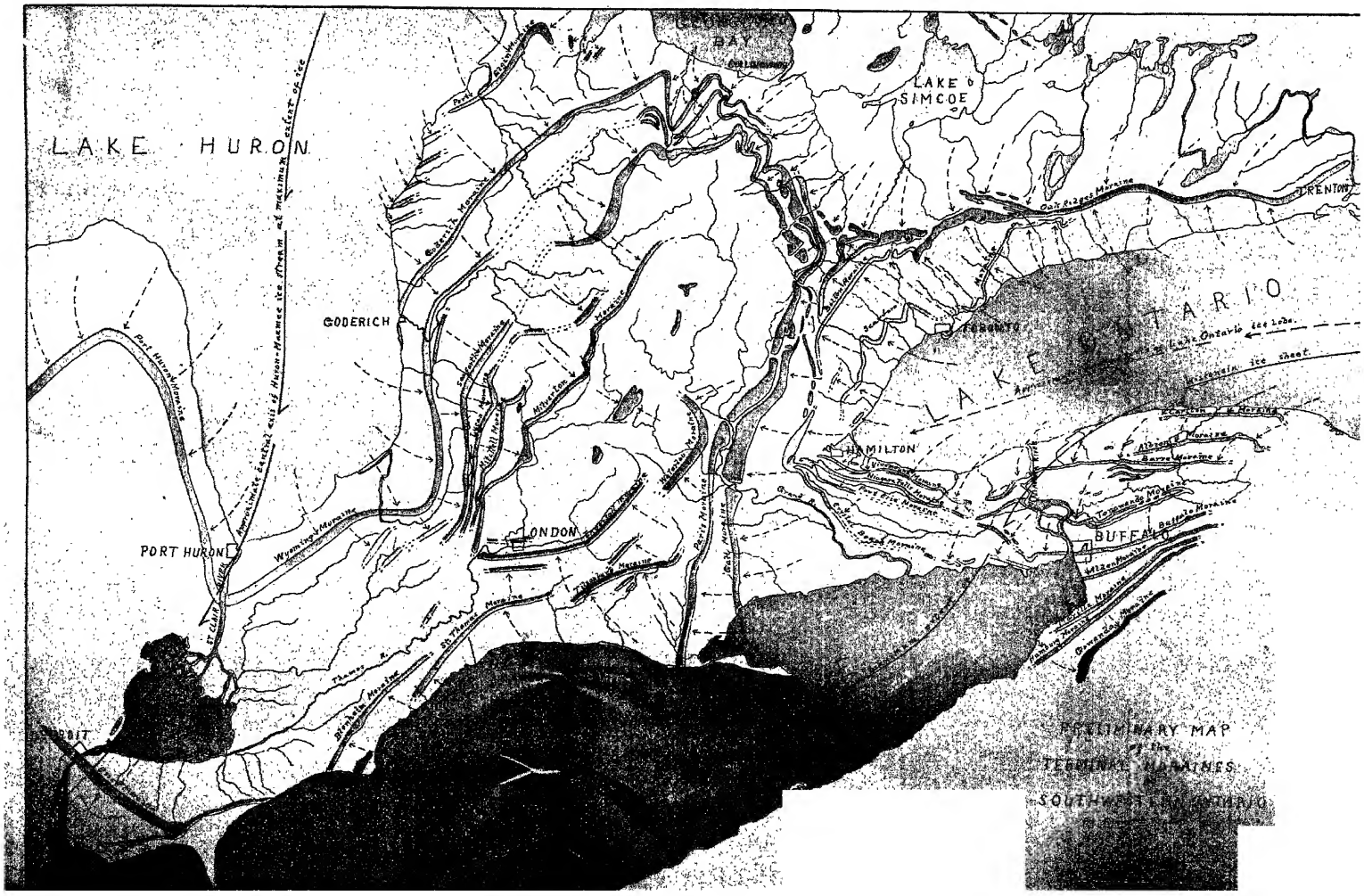
Fig. 11 Side view of a drumlin near Campbellville

is in some places 100 feet or more. The regions farther north and northwest have not yet been studied and the relations of this moraine are not fully made out. Between Glen Major and High Point its ridges appear to be overridden obliquely by the Oak Ridges moraine.

CONCLUSION.

In this paper I have drawn attention almost exclusively to the terminal moraines of the Wisconsin ice sheet. There is older drift in large quantities in some parts of the area, notably at Toronto and north and east of the city. It also forms a deep deposit in the region west and southwest of Lake Simcoe and several exposures of it were found at and near Niagara Falls. The most famous beds, however, are here in the city of Toronto and have been studied and most interestingly described by Prof. A. P. Coleman of Toronto University. Another citizen of Toronto, Mr. J. B. Tyrrell, has also contributed much to our knowledge of the Ice Age by exploring the centres of glacial accumulation in the Far North. Many other phases of the drift deposits might have claimed part of our attention, such as drumlins, eskers, kames, old drainage lines, lake beaches, deltas, etc. But the chief object was to present some account of the system of terminal moraines, and the number to be mentioned and briefly described was so great that there has been no room for the consideration of other forms. Some of the old river channels, however, have been mentioned, because they help so greatly in the interpretation of the successive positions of the ice front, and reveal at the same time the great function of the solid ice mass, sometimes as a barrier controlling rivers and at others as a greater barrier holding up lakes of larger size than the Great Lakes of to-day.

The very fragmentary and incomplete nature of the observations and studies here presented is of course evident. But in presenting the results I have not tried to conceal the unfinished state of the investigations, but have sought rather to point out the unsolved problems in the belief that this course will do more to arouse the active interest of others, and especially of Canadian geologists, than the selection of some more complete and specialised phase of the subject. I have sought to do no more than present a general view of the moraine system of southwestern Ontario, as far as it is now known, and to give some hints on the bearing of this system upon the development of the surface features of this part of the Province.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PORT HURON
LONDON
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TORONTO
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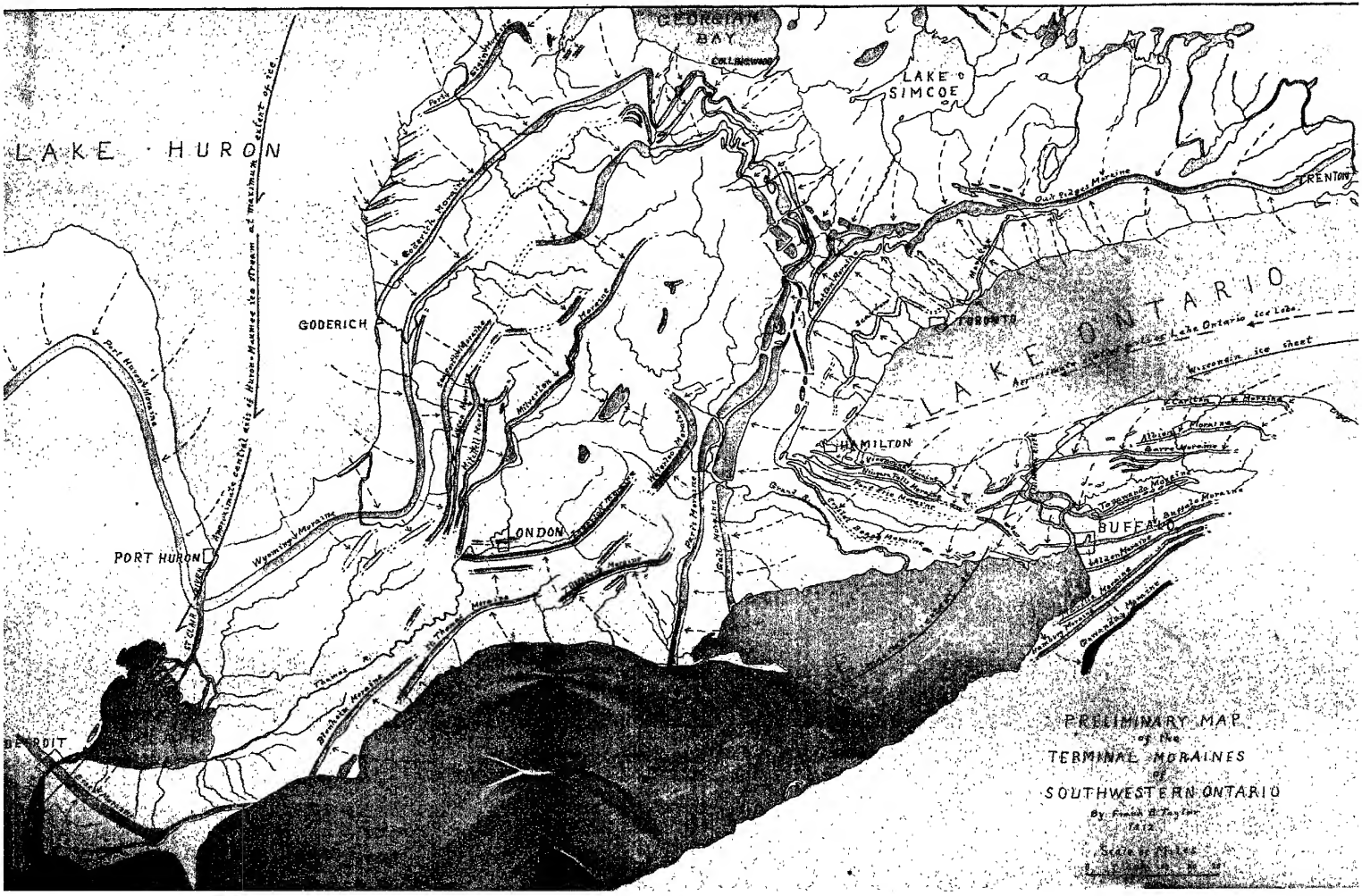
BUFFALO
LAKE ONTARIO
PRELIMINARY MAP
TERMINAL MORAINES
SOUTHWESTERN ONTARIO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HAMILTON
LONDON
BUFFALO
PORT HURON
DETROIT
PRELIMINARY MAP
of the
TERMINAL MORAINES
of
SOUTHWESTERN ONTARIO
By Frank B. Taylor
1912

A NEW CESTODE FROM *AMIA CALVA* L.

BY A. R. COOPER, M.A.,

(*Read 26th October, 1914*)

A few years ago, Professor R. R. Wright drew the writer's attention to a Bothriocephalid which, during the course of his earlier helminthological researches, he had found in *Amia calva* L. and believed to be entirely new. Later specimens of the same genus, and perhaps, too, of the same species, were procured from the same host taken in the vicinity of the Lake Biological Station on Georgian Bay; and, since a preliminary examination showed that the worm had apparently not yet been described, it was thought advisable to make it the subject of a more or less thorough investigation, and to publish the results.

The writer wishes to herewith express his indebtedness to Professor B. A. Bensley for valuable assistance and advice in connection with the preparation of this paper, and to Professor H. B. Ward, of the University of Illinois, for opinions on a preliminary description and for material from his private collection.

The following paper is concerned only with the morphology of the worm, a consideration of its systematic position having been dealt with in a second paper published in the Transactions of the Royal Society of Canada (Series III, Vol. VIII, 1914, pp. 1-5).

MATERIAL.

Apart from a few examples kindly sent to the writer by Dr. Ward, the material consists of worms ranging in length from a few millimeters to about ten centimeters, taken from the duodenum of three or four specimens of *Amia calva*, L. These were all fixed in Alcoholic-acetic-sublimate*, and stained in bulk for transparency-preparations with Meyer's Acid Carmine and in sections with Heidenhain's Iron-Haematoxylin and Orange G or Mallory's stain, the latter to bring out basement membranes in particular.

GENERAL APPEARANCE.

When removed from the anterior end of the intestine of the host to normal saline solution the cestodes are quite active, undergoing changes in length and breadth particularly in the middle and posterior portions of the strobila; those in the scolex and most anterior proglottides are less

*The Taenioid Cestodes of North American Birds, by B. H. Ransom; Proc. U.S. Nat. Mus., Bulletin 69, 1909.

extensive. When greatly extended they appear somewhat thread-like to the unaided eye, when contracted, during life or after preservation, if no care has been taken to stretch the specimens, somewhat like a string of fine beads, which characteristic has been incorporated in the specific name. This is due anteriorly to the thickened hinder ends of the foremost joints, while farther back it is caused by the uteri being greatly distended with eggs.

The largest specimens examined were two, 110 and 96 mm. in length, containing respectively 59 and 55 proglottides. From uncleared material the number of the latter is obtained by merely counting the joints forward and depending on the distension of the uteri—the male and female genital openings are very minute—in the hinder end of the strobila to indicate the sets of reproductive organs, there being no other in evidence of proglottidation in this region.

The scolex is quite small, simple externally, and with the unaided eye can scarcely be distinguished from the first joints. It is shaped roughly like a rectangular solid, hollowed out laterally to form simple depressions and dorso-ventrally the shallow bothria or organs of attachment. The summit is somewhat prolonged as a low pyramidally shaped disc, quite comparable to that ("Scheitelplatte") found in the members of the subfamily Triaenophorinae Luehe, 1899. Furthermore, although to all outward appearances this structure is unarmed, certain modifications of the cuticle on the edges, as well as on those of the foremost proglottides, to be described below, strongly remind one of the minute hooks with which *Ancistrocephalus microcephalus* (Rud.) is provided. The opposite end of the scolex is modified to form two pairs of auricular appendages closely resembling internally as well as externally those of the foremost joints (Fig. 1). The following measurements of scolex will be of use for future diagnoses of species:—

Width, at base of terminal disc.....	0.20 — 0.40 mm.
Width, at posterior end of bothria.....	0.17 — 0.25 mm.
Width, at tips of appendages.....	0.24 — 0.38 mm.
Length, including appendages.....	0.38 — 0.48 mm.

A neck is absent, proglottidation beginning immediately behind the scolex (Figs. 1, 5 and 6). Here the joints are short and crowded closely together even in relaxed states of the strobila. The appendages are united to form a sort of ring into which the narrow anterior end of the next joint fits, leaving recesses between these two parts, which pass forward a little farther laterally and dorsoventrally than at the ends of the diagonal diameters (Fig. 35). In many preserved specimens these

appendages with those of the terminal disc stand out as thin leaf-like structures, concaved anteriorly, thus suggesting their probable use as accessory organs of attachment ("Stützorgane") to the wall of the host's intestine. The bothria, although provided with a well-developed musculature (vide infra), would seem to be incompetent to securely fasten the worm; possibly the appendages of the scolex and foremost proglottides may combine to act as temporary suckers, as suggested by several authors. Unfortunately no observations on the methods of attachment were made on the living animals.

On passing backwards, the joints are seen to elongate considerably, especially in all parts ahead of the ring of appendages which remain relatively more constant in size. A transverse section through the former is oblong in shape, while one through the latter is more broadly elliptical to circular in outline. This part of the strobila is the most mobile, elongation often reaching the degree mentioned above in which the appearances are quite like a knotted thread. Fig. 2 shows different degrees of contraction in a portion of the chain, but it can be seen that the middle joint is naturally somewhat shorter than the other two. In many chains this region is subject to considerable variation. It was observed that now and then one of the longest proglottides was provided with one or two additional pairs of appendages, generally abortive and situated anteriorly some distance apart. In a few cases staining and clearing brought out a distinct division of the parenchyma, especially posteriorly, into what seems to be the beginnings of a division of the longer proglottis into several smaller ones. Furthermore in one strobila an undivided region was intercalated between two jointed regions, the the second of which was followed by the normal posterior end. Young scolices are shown in Figs. 5 and 6. (In this connection note evidence given below under the excretory system that the latter are incomplete). Although the foregoing facts point to possibly occasional augmentation in the number of proglottides in this region in adult worms, the usual appearances are as described below.

Beginning at the 15th to 17th, the proglottides enlarge somewhat abruptly until the size shown in Fig. 3 is reached. The dotted ovals here represent the gravid uteri which give rise to the distended appearances of the posterior two-fifths, or nearly, of the joints. There is also some increase in width anteriorly. On the other hand the auricular appendages gradually diminish in size, until after the 23rd or 24th joint they are not to be seen, the strobila then resembling a ribbon swollen at regular intervals, as mentioned above. For some distance farther the remains of the constrictions of the anterior ends of the joints are seen in slight approaches of the lateral borders, while still farther back a tendency

for material cleared in oil of cedar, which is very brittle, to break immediately behind the ovary is the only other indication, apart from the reproductive organs, of proglottidation. This tendency, however, so far as could be determined is not based on any differentiation of the parenchymatous tissues internally at this level but more probably on mere differences of support in the latter, the ovary rendering the parts immediately ahead more resistant to strain. The following are some relative measurements of a typical strobila (Fig. 3):—

Proglottis.	Length.	Greatest Width.
20	1.85 mm.	0.48 mm.
22	2.37 mm.	0.48 mm.
24	2.03 mm.	0.58 mm.

What is apparently the end-proglottis is rounded posteriorly (Fig. 12) and provided with a functioning set of genital organs. The endings of the excretory vessels in this joint, however, seem to point to some part of the strobila (perhaps, also, of the plerocercoid) being lost at an early stage (vide infra).

CUTICULA.

The cuticle, a well-developed structure excepting in the oldest portions of the strobila where it is often much torn or even missing over small areas, is from 3 to 4μ in thickness. It is divisible into two principal layers in each of which other layers can be distinguished. The outer of these, about two-thirds as thick as the inner, does not stain as well as the latter owing to the fact that it is made up of alternating dark and lighter areas arranged so as to give a striated appearance. The darker lines seem to be composed of minute granules while the lighter are more homogeneous (Fig. 7). Bounding this layer peripherally there is to be seen in many sections an extremely narrow clear line, followed by a sort of external limiting membrane, while in others, especially those through young strobilas, only very minute teeth which seem to be continuations of the darker lines are visible. The inner layer of the cuticula takes stains much more readily than the outer and is quite homogeneous with the highest magnifications. The line separating the two, however, is slightly darker than even the inner, which is perhaps due either to larger granules than those in the dark lines of the outer layer or a greater number packed more closely together. Bounding the inner layer on the inside there is a well-developed basement-membrane, brought out best by Mallory's stain. This is often separated from the homogeneous layer by a clear line as indicated in the figure. Then again just outside the basement-membrane the former is slightly granular in some quite thin sections. The cuticle is traversed at short intervals by the minute

excretory canals forming the foramina secundaria which appear in tangential sections as circular openings in a homogeneous matrix. Since these course through the cuticle quite obliquely, they give the latter the appearance of being pierced with holes at different levels. Two of them are shown in Fig. 7, one having reached the outside while the other has not yet passed the basement-membrane.

In many cases a splitting of the outer layer of the cuticle into processes takes place evidently along the lighter striations. It is quite conceivable that the cuticular processes, if not "cilia", described for many Bothriocephalids may arise in this manner in young scolices.

The cuticle covering the scolex is, on the whole, somewhat thinner than that on the posterior proglottides. This statement is also applicable to that on the inside of the auricular appendages of the scolex and foremost joints. The other modification of the cuticle, referred to above, is best seen in young scolices where the minute spines have not been worn away. It will be seen, by reference to Fig. 8, that the latter are developed as a thickening in the outer layer followed by a breaking up of the material into stout spine-like processes. These minute spines are restricted to a very narrow line running along the edge of the auricle, and are all directed towards the inner concave surface of the latter, that is, towards the central longitudinal axis of the worm. They gradually disappear with the appendages posteriorly. Since these spines appear in great numbers, and, since the appendages are provided with well-developed sets of muscles (v.i.), obviously arranged to activate them, they must be of actual service to the worm in obtaining a hold on the smooth mucous lining of the host's intestine.

SUBCUTICULA.

The subcuticular cells (Fig. 7) are not clearly defined as to boundaries but are fused together to form a syncitium the extent of which is indicated chiefly by the nuclei. There are, however, condensations of protoplasm around the latter in ripe proglottides, giving the appearance of columnar cells which have been described for many Bothriocephalids. These may even be more or less distinct towards the centre of the proglottis, yet they are directly continuous with processes from the cells of the parenchymatous tissue beneath, the whole forming in many places a meshwork of protoplasmic strand surrounding vacuoles, as shown in the left of the figure. The nuclei are comparatively large structures with well-defined walls, non-uniform in thickness, and clear contents, excepting for the deeply-staining "nucleoli". The thickness of the subcuticula varies in different regions, especially since its inner boundaries are rather indefinite, averaging about 25μ. Numerous processes proceed towards

the cuticula, beyond the basement-membrane of which they could not be traced. The space between the latter and the circular cuticular muscles stains less deeply, since there seems to be a condensation of protoplasm into strands which traverse it. In some places, in sections of young strobilas, these processes appeared to be more or less grouped opposite the columnar condensations in the syncitium, mentioned above. The subcuticula is poorly developed in the scolex.

PARENCHYMA.

The parenchyma is divisible into the usual parts, a medulla ("Markschicht"), at the centre of the strobila, surrounded by a cortex ("Rindenschicht"), extending to the subcuticula, the two being separated by the longitudinal muscles. This division into two parts is based rather on the arrangement of the nuclei, since the cytoplasm forms a very open reticulum, excepting immediately around the nuclei (Fig. 35), in which cell-boundaries cannot be seen. In the anterior proglottides most of the nuclei, each from 4 to 5μ in diameter, are restricted to two regions, those of the medulla close around the excretory vessels and nerve strands, those of the cortex, much more numerous than the inner lot, close to the subcuticula and among the outer transverse muscles. The myoblastic nuclei of the transverse (inner especially) and dorso-ventral muscles are easily confused at first sight with the nuclei of the parenchyma, but on closer examination they are found to be somewhat smaller and to contain more chromatin granules, a distinct nucleolus being difficult to locate. The nuclei of the parenchyma, on the other hand, are slightly smaller than those of the subcuticula. In Fig. 7 the two smallest nuclei farthest from the cuticle doubtless belong to the peripheral region of the cortex.

In young strobilas the parenchymatous reticulum is very vacuolated, being indicated mostly by granules at the intersections of fine protoplasmic strands, while in mature proglottides it is evidently used up for the growth of the reproductive organs which fill up almost the whole space within the subcuticula.

At the summit of the terminal disc of the scolex very many nuclei are crowded around the small shallow depression to be found there in many specimens, but they show no evidence of having any special function. Probably they have been pushed out of the immediate neighbourhood by the growth of the powerful muscles situated there (v.i.).

In all of the material studied there appeared to be no traces of chalk bodies in the parenchyma, not even spaces such as can be seen in plerocercoids of the genus *Proteocephalus*, which might have accommodated them before they were dissolved out by the acetic acid in the fixing fluid.

MUSCULATURE.

The musculature consists of two series of fibres, namely, the muscles of the parenchyma, coursing in three different directions, and those of the cuticle, which are closely related through what will be described below as the outer longitudinal group of the former. Since a careful study of the muscles was made, they will be dealt with somewhat in detail, beginning with the simplest histologically, the dorso-ventral and coronal fibres. Those of the scolex will be described separately.

In his researches on *Bothridium pithonis* Blain. Roboz ('82) was unable to find the myoblastic nuclei of the longitudinal muscles, which, he says, are pointed at both ends, but observed a longitudinal fibrillar striation. Zernecke ('95), working on several species, makes the following statements concerning the individual muscle-fibres: "Hier finden wir denn auch die von Salensky für die Muskeln von *Amphilina* beschriebene Differenzirung der Fasern in eine centrale (Mark-) und eine periphere (Rinden-) Schicht. Letztere umgiebt den centralen Theil als ein breiter Ring und ist von diesem durch die intensive Farbung zu unterscheiden. Sie ist von homogener Structur und starker lichtbrechend als das Centrum. Letzteres erscheint im Querschnitt als eine dunklere, feinkörnige plasmatische Markmasse"; further, "Hier (at the level of the myoblastic nucleus) ist der Zusammenhang der Marksubstanz mit der Zelle zu sehen. Die Rindenschicht bildet hier nicht mehr ein geschlossenes Rohr um die Markmasse, sondern offnet sich an einer Seite, so dass eine Rinne entsteht, durch welche das Plasma der Bildungszelle mit dem Mark communicirt." Essentially the same conditions were found in the musculature of this form, excepting that the peripheral layers of the individual fibres of all of the different groups are characterized by being broken up into a varying number of fibrils (Figs. 10a, b, c, and 9a) which diverge at the ends, excepting in the case of the longitudinal fibres of the parenchyma. An example from the coronal series (Fig. 9a) shows how the fibrils are related to the nucleus and cytoplasm. Although in most of the fibres of the longitudinal muscles the latter are situated close to the fibrils, as shown in Fig. 9d, others, Fig. 9b and c, are widely separated from them, the connection being scarcely visible in many cases. The two figures given are of the most distinct examples that were seen. The fibrils themselves are very easy to follow in every part of the strobila. In cross-sections of the external longitudinal fibres at certain levels, a large area of highly-staining material at one side of the fibre (Fig. 10a and b) was considered to be the remains of the nucleus, since no other trace of it was found. This and the fact that the myoblastic nuclei of the dorso-ventral fibres between the bothria were somewhat degenerate and quite closely related to the

fibrils (Fig. 10c) points to a specialization among many sets of fibres in the direction of the complete loss of the nuclei, the presence of which is made the basis of a classification of the muscles of cestodes by Braun ('94–'00).

The coronal or transverse series of muscles is arranged as two thin sheets of fibres lying immediately within the longitudinal muscles of the parenchyma, thus assisting the latter in forming the boundary between the medullary and cortical parenchyma. In transverse sections the fibres of these two layers diverge laterally so that the innermost cross or interdigitate before they become attached to the cuticle. In the posterior end of the anterior proglottis each layer sends many fibres to the auricular appendages of the same surface of the worm (Fig. 35), which curve slightly posteriorly to form part of the radiating fibres of the latter. While the dorsal and ventral bands are continuous from joint to joint throughout the anterior portion of the strobila, there is a decided augmentation in the number of fibres in the posterior portion of the proglottis opposite the auricles into which they pass. Farther back they diminish in number with the reduction in the size of the appendages, relatively more quickly in the forward part of the joint, until in the unsegmented hinder end only a few straggling fibres appear, in the interproglottidal regions, between the testes and the vitelline glands.

In addition to these another series of transverse fibres, more circularly arranged, appears in the anterior end of the strobila, especially well-developed in the first three or four joints. They are divided into eight groups, two for each surface, and are situated immediately beneath the subcuticula. Each group consists of parallel fibres arising along the whole of the edge of the proglottis ahead of the appendages and passing obliquely and posteriorly into the opposite appendage of the same surface. Thus there is a decussation in the mid-line, giving rise to rather complicated appearances in cross-sections. The two pairs of lateral groups which can be best seen in sagittal sections, are related to each other in exactly the same way; they are, however, not quite so extensive, as may be expected from the ligulate habit of the worm, the dorso-ventral diameter even in these foremost joints being considerably less than the transverse. Beginning at the base of the appendages, that is, the anterior edge of the ring (vide supra) to which they are attached, small groups of these coronal muscles are cut off from the inner groups at the ends of the diagonal diameters of the joint by the external longitudinal fibres of the parenchyma to pass back into the appendages and supply them with a circular musculature (Fig. 35). All of the oblique fibres gradually disappear with the auricles posteriorly, so that they are developed evidently

for the movements of the auricles alone. From their arrangement they doubtless serve, in conjunction with other fibres to be described below, to extend the appendages away from the body as the leaf-like structures mentioned above.

The dorso-ventral or sagittal muscles are divided into six groups by the three excretory vessels and the two nerve strands which in the foremost joints occupy most of the medulla and are situated so close together in many sections that only individual fibres appear between them. The fibres themselves are more numerous, like the coronal muscles, anterior to the junction of two proglottides where the four most lateral groups, i.e., those between the nerve strands and the lateral vessels and those outside of the nerve strands pass from auricle to auricle on each side of the worm (Fig. 35). In the forward end of the joint more fibres are situated between the vessels and fewer laterally. The middle lot could not be traced beyond the subcuticula, while the lateral groups, on the other hand, can be easily followed to the cuticula of the auricular ring and appendages, in which latter they, along with the coronal fibres mentioned above, constitute the transversely radiating group. Farther back they dwindle down gradually until in gravid proglottides only a few coiled fibres appear between the testes and vitelline follicles or alongside the cirrus-pouch and uterine-cavity. The individual fibre closely resembles that of the coronal series, shown in Fig. 9a, excepting that it is shorter.

The longitudinal muscles of the parenchyma are divisible into two series, an inner and an outer, of which the latter appears only in the anterior end of the strobila. In transverse sections through the middle of the foremost joints they are arranged in small groups, with no constant number of fibres in each, in two concavo-convex bands between the medullary and cortical parenchyma, that is, about half way from the centre of the section to the periphery excepting laterally where they are situated relatively farther out. Here the thin edges come together immediately outside of the nerve strands. Throughout their course transversely they are penetrated by the sagittal muscles. As one nears the very short region between successive proglottides, in following through a transverse series, some of the fibres (more correctly fibrils, from the above view of the constitution of the fibre) decrease in diameter and number, especially laterally, and become more loosely arranged, as they diverge from one another. Immediately ahead or behind, as the case may be, they again appear as above. On the other hand a great many pass from joint to joint uninterrupted. From this fraying out of the fibres between successive joints it was concluded that the lengths of some of them, at least, did not exceed that of the proglottis: in the mature,

unsegmented portion of the strobila the question of the length is a very difficult one to decide upon. Perhaps only the longer kind is to be found here, since, as above stated, no indication of proglottidation, apart from the separate sets of reproductive organs, was detected. There is thus a certain amount of interruption in the course of the longitudinal muscles corresponding to the division into proglottides as pointed out early by Leuckart for *Taenia saginata* Goeze (Braun '00). Furthermore, there is a slight contraction of the whole cylinder of fibres as the interproglottidal space is neared (Fig. 37), which is not to be seen after the auricles have disappeared.

The outer longitudinal muscles appear only in the anterior proglottides and scolex in connection with the appendages, for the movement of which they are obviously developed. In the anterior half of the proglottis they lie very close to the longitudinal cuticular muscles from which they can be distinguished only by their slightly larger size. As they pass the slight indentation which in coronal series marks the anterior end of the appendage, they are joined by other fibres attached to the anterior portion of the outer wall of the latter, so that when they are converging towards the center to pass into the next porglottis, they form a ring of fibres more prominent in cross-section than those of the inner longitudinal group (Fig. 35). Throughout their course they are also more prominent opposite the auricles than at the ends of the dorsoventral and transverse diameters. Just ahead of the sinus or pocket behind the auricle a few fibres are cut off from the main body to pass about half way along the inside of the appendage. The latter is further supplied with very many fibres belonging to the same group (Luehe '97) which pass between its outer and inner walls to the very tip (Fig. 37) and, by their contraction, obviously serve to protract the edge of the auricle and thus to allow the minute spines to catch in the mucous lining of the host's intestine. As the appendages diminish in size this series of muscles gradually becomes restricted to the hinder end of the proglottis and eventually disappears with the former.

Thus, so far as proglottidation in relation to the arrangement of the external longitudinal fibres is concerned, this species resembles *Ligula uniserialis* Rud. and strongly substantiates Luehe's generalization that: "wenn die Proglottiden eines Cestoden, wie dies in der Regel wenigstens bei jugendlichen Proglottiden der Fall ist, am Hinterende einen grösseren Querschnitt besitzen, als am Vorderende, dergestalt, dass die einzelne Proglottis mit einem seitlich abgeflachten Kegel verglichen werden kann und ein Langsschnitt durch mehrere Proglottiden eine der Schneide einer Säge ähnliche oberflächliche Begrenzung besitzt, so sind stets auch Muskelfasern vorhanden, welche an der Aussenflache

der Proglottis entspringen und sich z. T. am Hinterende derselben den Bündeln der ausseren Langsmuskeln beigesellen, z. T. an der freien Hinterflache der Proglottis inseriren. Diese Muskelfasern werden nur dort vermisst, wo entweder eine aussere Gliederung fehlt oder die einzelnen Glieder nicht jene, fur die jugendliche Proglottis charakteristische, regelmässige Form eines abgestumpften und seitlich abgeflachten Kegels besitzen."

The cuticular muscles are arranged in the unjointed portion of the strobila in the typical manner, while anteriorly they are modified somewhat in relation to the great development of the appendages. The outer cuticular fibres follow the cuticle closely (Fig. 7) even on the outside of the auricles and are diminished in number and size only opposite the bands of minute spines (Fig. 8). The longitudinal fibres, on the other hand, are largest and most numerous on the outside of the appendages to the tip of which they extend, while only a very few appear on the inside, being connected with those of the following proglottis after passing forward around the auricular pockets. This description applies also to the scolex in which, however, all of the cuticular musculature is not so well developed.

The musculature of the scolex is essentially the same as that of the anterior proglottides, but there are in addition two sets of fibres which do not appear in the latter. Furthermore, all of the muscles are better developed, that is, more numerous and larger, as one might expect in this portion of the strobila, specially differentiated for adhesion.

The coronal fibres are first seen about 70μ from the summit, after which they become more numerous, especially opposite the posterior boundaries of the longitudinal arcuate fibres (vide infra) then again opposite the appendages into which many of them pass as in the foremost joints. Their arrangement is shown in Fig. 34, a section through the middle of the scolex. The other series of coronal or transverse muscles in the scolex, the obliquely decussating group, are related to the auricles as are those in the proglottides immediately behind, excepting that they do not pass relatively so far forward at the edges or "walls" of the bothria (Fig. 36). A third series of transverse muscles, one of the two sets mentioned above, is composed of large fibres arranged concentrically towards the centre of the scolex from the edges of the bothrial walls (Fig. 34), which they protract, thus helping to deepen the bothria during attachment. They are situated in the middle third of the scolex, not extending beyond the limits of the bothrial depressions. These fibres interdigitate somewhat laterally and intermingle dorsoventrally with the attenuated edges of the sagital fibres. They are quite homologous with the four groups

of fibres figured by Zograf ('92) for the scolex of *Triaenophorus nodulosus* (Pall.) and observed by the writer in confirmatory sections.

The sagittal fibres are arranged in the posterior portion of the scolex in quite the same way as those of the foremost joints. As you follow them forward, however, the two middle groups, that is, those between the excretory vessels, which separate somewhat to accommodate them (Fig. 34), enlarge considerably to form the chief muscles of the bothria. Contraction of these in conjunction with that of the tangentially arranged transverse fibres will deepen the bothria and thus form an efficient sucking-apparatus. By their relaxation and the contraction of the coronal fibres the bothria will, on the other hand, be loosened from the substratum. Anteriorly the dorso-ventral fibres gradually diminish in number and size until none appear in the first 70μ of the scolex from the summit.

The inner longitudinal muscles of the parenchyma do not pass to the tip as in many Bothriocephalids, but only about half way along the scolex, where they disappear.

The outer longitudinal fibres are arranged as in the foremost joints, but they are slightly more numerous. They extend forward as four groups each of which is situated near poorly developed cuticular muscles at the edge of the bothrial wall outside of the tangential groups (Fig. 34) ahead of which they do not appear, that is, they do not pass to the tip of the scolex.

The second group of muscles peculiar to the scolex only is to be seen in its anterior third. These are longitudinally arcuate fibres arranged concentrically around the edges of the terminal disc in four groups, one at each end of the diagonal diameters of the section through this region. Their function is obviously to protract the edge of the former with its bands of minute spines (Fig. 37).

The individual fibres of the transversely and longitudinally arcuate as well as those of the dorso-ventral bothrial muscles are comparatively short and spindle-shaped. Approximately their middle thirds take the strain much more readily (Figs. 34 and 37) than their ends which seem more muscular in composition and can be easily followed to the cuticle. This is due to the fact that it is in this middle portion that most of the cytoplasm and the nucleus are located (Fig. 10c).

The musculature of the end-proglottis bears out the above statement that an earlier portion of the strobila seems to be missing. The longitudinal muscles of the parenchyma dwindle down rapidly, the individual fibres diverging near the end-vesicle of the excretory system, while the cuticular fibres, excepting a few circular ones which pass farther on towards the latter, quickly disappear among the much altered subcuticular cells on the hinder border of the terminal joint (Fig. 12).

NERVOUS SYSTEM.

The nervous system consists of a nerve-ring situated immediately beneath the tip of the scolex and covering the median excretory vesicle (vide infra) like a cap, and the two chief strands passing back from it through the whole of the strobila. The former is a comparatively weakly developed structure (Fig. 11), elliptical in transverse section, with diameters of 60 and 40μ. The chief nerve strands are 18μ in diameter in the scolex, in which they are situated between the middle and lateral thirds of the medullary parenchyma (Fig. 34), while in the anterior proglottides they are somewhat larger, excepting in the interproglottidal region. Here they narrow down suddenly to a diameter of 8μ. In the posterior unsegmented portion of the strobila they are quite flattened laterally, opposite the gravid uterine sacs (Fig. 19), on the whole somewhat smaller than in the jointed region and situated in the medulla but quite close to the longitudinal muscles (Fig. 18). The nerve-ring gives off besides the two chief nerve strands, eight others, four being grouped around each of the former (Figs. 34 and 35). It was at first difficult to decide whether these were distinct strands or only the intersections of an extensive meshwork of nerves situated in the cortical parenchyma and thus comparable to the "plasmatische canal system" of Sommer and Landois ('72); however, with further search eight strands could be followed throughout the segmented portion of the strobila. The difficulty in following them is due to the fact that the nervous branches given off mostly centrally are quite as large as the strands themselves and that they anastomose freely with one another and with the chief strands which are, however, much more distinct. These collateral nervous tracts gradually disappear with the appendages posteriorly. Thus they are apparently developed in connection with the extra musculature of the latter. Since the Golgi method of impregnation was not used on any of the material for this study, the nerve-strands were seen to be made up of only a very fine fibrillar meshwork containing extremely minute granules and vacuoles.

EXCRETORY SYSTEM.

There are three excretory vessels coursing throughout the strobila, a large median one evidently the morphological equivalent of the dorsal pair of many Bothriocephalids and two much smaller, ventro-laterally situated, all being located in the medullary parenchyma ("Markschicht") between the chief nerve strands (Figs. 34, 35 and 37). Immediately behind the nerve-ring the median vessel expands to form a somewhat spherical vesicle from 25 to 40 μ in diameter, into which the lateral

vessels open without any change of diameter. The junction of the median vessel and the vesicle is, on the other hand, not abrupt but gradual or funnel-shaped. In the scolex all three vessels take a comparatively straight course, gradually narrowing until, as they enter the first proglottis, they are, median, 30μ, and lateral, 8μ in diameter; while in the anterior proglottides they take the form of irregular spirals, the coils of the lateral vessels following more or less those of the median, excepting as they pass the interproglottidal space where they narrow down and straighten out slightly. The comparatively small size and straighter course of the vessels in the scolex is doubtless due to the great development of the dorso-ventral bothrial muscles through which they pass.

Posteriorly their course is modified by the development of the reproductive ducts in the median line. This applies more particularly to the larger median vessel, since the other two, being situated ventro-laterally, are not much disturbed. Between the sets of reproductive ducts the median vessel lies in the median coronal plane, separating the testes into two lateral fields (Figs. 17 and 18), while the smaller vessels are situated below the testes but within the ring of vitelline follicles. As the former approaches the cirrus-sac it usually rises (it is somewhat depressed in Fig. 38) and passes dorsally to the right or left, along the uterus-sac and over the ovary and lateral portion of the generative space to the median line again. However, it frequently crosses from one side to the other dorsal to the anterior end of the developing uterus-sac or the space between it and the opening of the vagina, as shown in Fig. 17. But the greatest changes in the course of these vessels comes when the uterus becomes gorged with eggs. The smaller vessels then appear greatly flattened laterally, within the testes that appear in these sections, and not so distinctly towards the ventral surface (Fig. 19). No trace of the larger median vessel is to be seen along the middle of the uterus-sac excepting in younger stages where it is in the form of an almost obliterated tube situated dorso-laterally. Anteriorly and posteriorly, however, in several series this vessel apparently passed right into the uterine sac tangentially, the opening thus being closed with a flap-like valve. While this was very difficult to make out and was considered of only secondary importance, it was thought that perhaps the much distended condition of many of the uteri in the posterior end of the strobila, especially behind the region of closure of the temporary uterine opening (vide infra), might be due to fluid from the median vessel escaping into the uterine cavity by the absorption or rupture, during distension, of the two extremely thin walls between.

The relations of the excretory vessels in what has been called the end-proglottis are rather peculiar. The median vessel (Fig. 12) gradually

expands to form a vesicle, varying in diameter from 25 to 55 μ and is situated immediately within an invaginated portion of the cuticle into which it opens. The openings of the lateral vessels are very difficult to make out, since they seem to be quite closed in many cases. All stages between the condition shown in Fig. 12 and one (in small scolices, Fig. 6) in which all three vessels opened separately on the concave posterior surface of the strobila, were observed. Thus it would appear that this species bears out Leuckart's view that the relations between the posterior openings of the excretory system are developed after some part (in most cases an earlier proglottis) has been separated from the strobila. In fact Fig. 12 is quite suggestive in all of its parts of a simple contraction of the hinder end of the worm to form a cuticular invagination, all of the vessels formerly opening on the outside.

The flame-cell (Fig. 13) is quite typical in structure and closely resembles that of the genus *Proteocephalus* Weinland, which has been studied by the writer, in that the vestibulum in which the "ciliary flame" is located is provided with peculiar darkly-staining longitudinal thickenings which do not seem to be mentioned in the literature on the excretory system of the cestodes. Their significance is, of course, merely conjectural. The cell-body is usually not as distinct as that shown in the figure, since the cytoplasm is quite clear, but the nucleus and basal body, as well as the "flame", are very easily made out in sections. It was found impossible to trace with certainty the canaliculus from the flame-cell to any of the larger vessels or smaller canals mentioned below. The flame-cells, themselves, are few in number and arranged more or less radially close around the large vessels.

The structure of the latter is shown to a certain extent in Fig. 14. Although the wall is extremely thin, the following parts could be discerned with high magnifications: a thin cuticular layer, with a distinct basement membrane, lining the tube; outside of that a clear line in transverse sections and dotted in longitudinal sections, thus resembling a layer of extremely fine cuticular muscles; and farthest peripherally, a condensation of cytoplasm with nuclei slightly smaller than those of the parenchyma, but hard to distinguish from the myoblastic nuclei near at hand. The circular striations appear to be more protoplasmic than muscular in nature and in many places cannot be differentiated from the basement-membrane.

Foramina secundaria are to be found in the anterior proglottides, especially on the outside of the ring to which the appendages are united (Fig. 35). The openings, themselves, are very minute (vide supra, under the cuticula), but the course of the capillaries leading to them through the subcuticula and peripheral portions of the cortical parenchyma is

clearly defined by the contents being highly stained by counterstains such as Orange G. In spite of the readiness with which these capillaries can be followed through the subcuticula, it was found impossible to trace them far towards the centre of the strobila, much less to connect them with any of the main excretory vessels. In the cortical parenchyma, however, they seem to unite to form a quite compact plexus, the diameters of the tubes of which vary from 2 to 6μ. In the foremost joints there are more foramina secundaria on the anterior portion of the proglottis than on the auricular ring; while very few are to be met with in the scolex.

GENERATIVE ORGANS.

There is a more or less definite point in the strobila, at or about the 15th proglottis, ahead of which the genital organs do not seem to develop and behind which in older strobilas they appear very quickly. For instance, in one strobila 96mm. long and containing 55 joints, only the beginnings of the vitelline follicles are to be seen in the 14th joint; more and a few testes in proglottis 15; no appearance, in sections, of the generative ducts in the median line in the 14th; a mass of nuclei around the median excretory vessels (from transparent preparations) in 15; and an uterus full of eggs in 16! One must look then to the younger strobilas in which the proglottides are yet immature to see the earliest stages in the development of the reproductive organs, especially of the ducts. Here, of course, the stages are more gradual.

The genital ducts develop from a long, more or less cylindrical anlage surrounding the posterior half or two-thirds of the median excretory vessel, as shown in Figs. 15 and 16, which are from transparencies of proglottides 16 and 17, respectively, of a young strobila. Soon after the earliest traces of it can be seen in transparent preparations, the anterior end enlarges to become later the anlage of the cirrus-sac and entrance to the vagina, while the posterior end gives rise to the ovaries and organs of the "generative space", including the "uterine tube". From the middle part arises the "uterine sac", vagina and vas deferens.

All of the ducts seem to develop lumina almost simultaneously, but the vagina and cirrus do not pierce the ventral wall of the proglottis until somewhat later. Even the uterine sac approaches the ventral surface at its posterior end in the early stages. During the necessarily brief study of the development of the genital ducts the writer was able to corroborate, in general, the finds of Young ('13) and Schaefer ('13) as to the manner of formation of the lumen and epithelium from the syncitial anlage. Further remarks on the possible fate of the epithelial nuclei during the formation of the cuticle in the distal portions of the ducts will be met with below in connection with the more detailed description of the

cirrus and vagina. The fact, however, that the epithelium of the genital ducts of this species seems to be almost entirely a syncitium, even in the mature proglottides, should have special emphasis at this point.

The cirrus and vagina open very close together (actually from 0.02 to 0.07 mm. apart) on the ventral surface, about two-fifths of the length of the proglottis from its anterior end, in that part of the strobila where the auricles define the extent of the joints and relatively much farther forward posteriorly where proglottidation is absent (Fig. 17). This latter is partially due to the developing uterus-sac pushing them farther forward. There is no genital sinus, although in some states of contraction a more or less well-defined depression into which the two ducts appear to open, much resembles one,—in fact in some proglottides the cirrus and vagina open into each other on the ventral surface. The opening of the uterus is to be found on the ventral surface also, just ahead of the posterior end of the uterus-sac.

All of the reproductive system is accommodated in the medullary parenchyma, and, excepting testes and vitelline glands which are situated peripherally, the latter immediately within the longitudinal muscles of the parenchyma, all parts are much elongated antero-posteriorly, an adaptation apparently to the narrowness of the strobila. The limbs of the ovary are even squeezed together, making the whole organ horseshoe-shaped.

The "generative space", that is, the space enclosed by the limbs of the ovary, is filled with the proximal ducts of the female system (Fig. 27).

MALE SYSTEM

In young proglottides, in which the uterus-sac is short and narrow, the testes are from 55 to 70μ in diameter and almost spherical in shape (Fig. 18), while in those in which the uterus is gravid they are ellipsoidal and from 70 to 115μ long. Opposite the distended uterine cavity and near the reproductive ducts behind and forward they are more or less flattened—in the former position, greatly flattened (Fig. 19).

Like the vitelline glands the testes are continuous from one proglottis to the next. They are separated into two lateral fields by the medially situated genital ducts but come together in front and behind these, in the interproglottidal regions, to form a layer, also divided by the median excretory vessel (Fig. 18). This layer, which is situated in the medullary parenchyma, is made up of as many as six testes, in cross-section, three on each side and all in the medial coronal plane of the body. No more than one testes at a time is seen on each side of the section through the gravid uterus-sac (Fig. 19). In mature joints it is difficult to say how many testes there are, but from the posterior edge of the ovary of one set of genital organs to that of the ovary of the next there are about 40 in each lateral field, or about 80 in all (Fig. 17).

Each testis is surrounded by a very thin membrane which is directly continuous with the wall of the vas efferens (Fig. 20), a point which is rather difficult to make out since the testes are packed closely together and the vasa efferentia anastomose freely between them. Numerous, even about ten, developing cytophores in various stages may be seen in the younger testes.

The anastomoses of the v a s a e f f e r e n t i a are best seen in the vicinity of the posterior end of the vas deferens (Figs. 17, 21 and 22) and not so well, among the testes laterally and in the interproglottidal regions. Thus it is conceivable that sperms developed in testes situated in the regions between the sets of genital ducts may find their way to the vas deferens of the same proglottis or to that of the proglottis ahead or behind, as the case may be. This would be facilitated by the rupturing of the delicate walls of the testes, which alone separate them in ripe joints, to form larger and more accessible channels for the sperms. Many instances of such ruptures were seen in the serial sections studied. Sommer and Landois ('72) found that the testes in the anterior part of the proglottis of *Dibothriocephalus latus* (Linn.) passed their sperms to the vas deferens of the joint ahead, but these relations were not found in this species in spite of the otherwise general resemblance between the arrangement of the genital ducts of the two. The vasa efferentia, themselves, vary considerably in diameter and possess very thin walls in which scattered and flattened nuclei are situated, as observed by Lonnberg ('91) in *Bothriocephalus rugosus* (Batsch), (Figs. 20 and 21).

Just ahead of the uterine opening the vasa efferentia unite to form a rather indefinite s p e r m r e s e r v o i r, directly continuous with the posterior end of the vas deferens (Figs. 17, 21 and 22) and thus resembling the similar structure of many Bothriocephalids. Its walls are intermediate, as to the structure of the epithelium, between those of the vasa efferentia and those of the vas deferens (Fig. 21). The anterior boundary of the sperm-cistern is marked by the position of the foremost of one to three separate vasa efferentia which join the vas deferens on that side towards which the latter is directed in development (vide infra); rarely do vasa efferentia empty into the vas deferens ahead of this short region.

While it was found impossible to determine the lengths of the s p e r m a t o z o a in sections, it was noticed that their anterior ends were differentiated as quite long and narrow cylindrical heads, slightly larger in diamenter than the rest of the sperm, evidently pointed at their anterior ends and graduated less abruptly towards the tail. These heads stain very densely with Heidenhain's Iron-Haematoxylin and are consequently quite easy to pick out, while the other parts are scarcely discernable in the masses to be seen in various portions of the male ducts.

The vas deferens passes forward from the sperm-reservoir almost in the median line and dorsal to the uterus-sac, taking many irregular coils in its course (Fig. 17). In older proglottides, however, owing to the relatively enormous distension of the latter, it is pushed to one side until all parts, excepting those close to the vesicula seminalis, may eventually become obliterated. It seems to be crowded more often to the right, doubtless because of its position in younger stages; at any rate, the anastomotic reservoir formed at its posterior end by the vasa efferentia lies more often to the left. Fig. 17 is an exception to this, as it is a dorsal view.

In ripe joints before it is pushed aside by the developing uterine cavity, the vas deferens is tubular in shape, from 11 to 14 μ in diameter at its anterior end where it joins the vesicula seminalis, 17 to 25 μ at its middle and 22 to 35 μ at its posterior expansion, the latter being the diameter of the sperm-cistern. Later when it becomes gorged with sperms and the walls are, in consequence, thinner, the diameter varies from 40 to 55μ.

The wall of the vas deferens consists of a low epithelium in which, as in the sperm-reservoir, no cell boundaries can be made out, supported by a poorly-developed basement-membrane (Figs. 21, 23a and b). It is thus a syncitium. In older proglottides, where the vas deferens contains sperms, the epithelium is flattened out so that the nuclei appear here and there along the duct as thickenings in an otherwise thin membrane. In young, and, as yet, non-functioning vasa deferentia nuclei from the outer layer of the anlagen remain close to the basement-membrane, especially towards the vesicula seminalis, to form the myoblasts of scattered and fine circular muscles (Fig. 23).

The vesicula seminalis, which is morphologically an expansion of the vas deferens, is situated close to the dorsal body-wall, immediately behind the cirrus-pouch (Fig. 17). It is ovate to spherical in shape in mature proglottides, before it is flattened against the latter by the gravid uterus-sac, with the more pointed end directed anteriorly, while in younger (but ripe) joints it graduates less abruptly posteriorly, that is, it is more broadly spindle-shaped. The wall has the same structure as that of the vas deferens, excepting that the syncitial epithelium is so much thinned out, especially when the organ is filled with sperms, that the nuclei, which appear singly or in groups of two or three and surrounded by small amounts of clear cytoplasm, seem to be applied to the inside of the basement-membrane itself. Outside of the latter there are to be seen numerous fine muscle-fibres, with their myoblastic nuclei, coursing in general longitudinal and circular directions. These are similar in structure to those surrounding the vas deferens. On

account of the extremely small size of these fibres it was found impossible to determine whether they are arranged in one or more layers. The following are the averages of the measurements of four vesiculae seminales:—

Length.	Width.	Depth.
0.140 mm.	0.092 mm.	0.090 mm.

The vas-deferens narrows very abruptly again to a diameter of 15μ as it enters the postero-dorsal portion of the cirrus-sac (Fig. 17) to become the ductus ejaculatorius. This portion of the duct takes three of four turns in the dorsal third of the cirrus-pouch and then passes on as an enlargement, the second vesicula seminalis, occupying approximately the middle third of the pouch (Fig. 38). While the walls of the proximal portion of the ductus ejaculatorius quite closely resemble in structure those of the vas deferens behind the larger or posterior seminal vesicle, those of the distal vesicula seminalis are very thin, showing few nuclei closely applied to the basement-membrane. The diameter of the duct at this point is about 38μ. As the junction between the ductus ejaculatorius and the inner vesicula seminalis is approached the epithelium becomes broken up into numerous processes which, however, did not appear to be true cilia. As a matter of fact cilia do not seem to present in any part of the male reproductive ducts.

The third division of the vas deferens within the cirrus-pouch, the cirrus proper, usually commences at the posterior pole of the latter, courses forward and then backward again to pierce the wall of the pouch and open on the ventral surface of the proglottis at the point shown in Fig. 17. The diameter of the cirrus at the bend in its course (Fig. 38, c) is about 20μ; it enlarges gradually to 30μ before opening to the outside.

This region of the male duct can be evaginated, presumably, as in most cestodes, to form a copulatory organ, yet in all the material at hand not a single case of everted cirrus was observed. Consequently, nothing can be offered, in regard to its function, apart from the suggestion that from the frequent approximation of the male and female genital-openings, noted above, self-fertilization may possibly occur in this species. The structure of the cirrus would at least indicate that after eversion it might become quite an efficient organ. Its wall (Fig. 24) is composed of an inner lining of cuticle thrown into folds of varying heights, supported by a basement membrane which can be distinguished as such only in young stages. Outside of the latter appear two sets of circular muscles (Fig. 24, cm), separated by a comparatively clear protoplasmic area which is traversed by the longitudinal and the retractor fibres (rmp) and numerous

processes from parenchymatous cells lying farther out. The circular muscles increase in number at the opening of the cirrus and form a distinct sphincter. In that portion of the cuticle next the lumen, that is, towards the functional outer surface of the organ, there are to be seen numerous highly-staining granules which seem to be the bases of fine bristle-like processes extending into the lumen. While the granules show very plainly in sections, the processes themselves are difficult to make out clearly in many cases. They are, however, probably homologous with the spines, hooks, etc., described for the cirri of other species.

Fig. 25 shows a somewhat younger stage in the development of the cirrus than that shown in Fig. 24, and is of interest in connection with the problem of the formation of the cuticle. Considerable attention was paid to detail in this figure in order to bring out the following points. It will be seen that four or five nuclei lie close to the cuticle, in fact against the basement-membrane, while others farther out appear to be connected with the cuticle, or at least with the syncitium of protoplasm immediately outside of it, by fine strands. Many of these peripherally situated nuclei belong to the myoblasts of the circular muscle-fibres, as indicated by the letters "cmc", and some of them to the few longitudinal fibres, but they, especially the former, are fairly easy to distinguish from the majority of the number which have the central protoplasmic connections. Young ('13) and Schaefer ('13), working with different species of cestodes, came to quite opposite conclusions regarding the fate of the epithelial nuclei during the formation of the cuticle in the distal portions of the vas deferens and of the vagina. Young asserts that the nuclei disintegrate in situ as the cuticle is being formed, while Schaefer observed what is doubtless the migration of the nuclei into the surrounding cytoplasm. The writer does not pretend to have gone into the matter at all exhaustively, but from the few observations he has made on the material studied it would appear that this species falls into line with Schaefer's discoveries. At any rate, no conclusive evidence of nuclei having disintegrated in situ in either the cuticle of the cirrus or that of the vagina was met with, but appearances like that shown in Fig. 25, where the original syncitial nuclei seem to have migrated some distance from the developing cuticle, retaining their protoplasmic connections and possibly functioning in the formation of that layer by secretion, are very common. In later stages, evidently when the cuticle is completely formed, these connecting strands fuse with the general mass of parenchymatous cytoplasm surrounding the cirrus and its retractor muscles, giving the appearances shown in Fig. 24. More will be given below in this connection under the vagina which, on account of its comparatively greater length, is better adapted to show the stages in the development of the cuticle.

The cirrus-sac is situated about midway between the dorsal and ventral surfaces of the proglottis, immediately ahead of the vesicula seminalis (Figs. 17 and 38). In shape it is spheroidal, being flattened laterally and somewhat protracted ventro-posteriorly where it follows the cirrus to the latter's opening, as the following measurements indicate: longitudinal diameter, 0.16 to 0.21 mm.; transverse diameter, 0.14 to 0.16 mm.; vertical diameter, 0.18 to 0.20 mm.

The wall of the cirrus-pouch, although quite thin, is wholly muscular and composed of two sets of fibers which can be better distinguished as such in younger proglottides than in older or gravid joints where they course irregularly and obliquely. Of these two sets the inner are circularly disposed while the outer are arranged longitudinally, thus corresponding to the description, by Sommer and Landois, of the parts in *Dibothriocephalus latus*. The fibers in the postero-dorsal portion of the wall intermingle with those of the vesicula seminalis; postero-ventrally they converge towards the opening of the cirrus, around which, with the dorsoventral parenchymal fibers of the immediate neighbourhood, they attach to the cuticle of the ventral surface. A very few fibers, on the other hand, difficult to distinguish from these dorsoventral parenchymal muscles, pass from the dorsal wall of the cirrus to the dorsal body-wall. Thus retraction of the cirrus, if, indeed, it is ever everted, would appear to be brought about by the mere elasticity of its tissues and of those surrounding it.

The dorsal half to two-thirds of the space within the cirrus-sac, which accommodates the ductus ejaculatorius and its expansion, the second vesicula seminalis, is filled with numerous parenchymal cells grouped irregularly around the duct outside of the fine longitudinal muscular fibers following the course of the latter. The myoblastic nuclei of these are visible as spindle-shaped, highly-staining bodies, closely applied to the fibers themselves. The ventral half to one-third of the space, on the other hand, appears much more compact in sections and transparent preparations, since it is in this region that the large retractor fibers of the cirrus are located. The latter are arranged in groups (Fig. 24) and attached evidently to the cuticle centrally, while they intermingle peripherally with the fibers composing the wall of the sac. The myoblastic nuclei are related to these fibres as in the case of the longitudinal muscles of the parenchyma, that is, one nucleus is associated with three or four fibrils. In addition to the circular fibers situated immediately outside of the cuticle of the cirrus proper, there are other finer ones to be seen for some distance beyond the cytoplasmic area, above-mentioned, intermingling with the large retractor fibers (Fig. 24).

FEMALE SYSTEM.

The v a g i n a opens on the ventral surface of the proglottis immediately behind the opening of the cirrus and from 0.02 to 0.07 mm., from it (Fig. 17). While in most cases the aperture is circular in outline and from 20 to 30μ in diameter, it is occasionally found in preserved material to be transversely elongated, more especially when it approximates the male opening (vide supra). The first portion of the vagina is in the form of a somewhat elongated vesicle, 56 μ in transverse diameter and situated beneath the vesicula seminalis; it is quite comparable, in shape at least, to the "Scheideneingang" of Sommer and Landois. After being slightly deflected dorsally, as in *D. latus*, the duct then passes back along the ventral side of the uterus-sac, on either side of the median line, or crosses from one side to the other at different levels ahead of the uterus-opening—in young proglottides ahead, necessarily, of the limb of the uterus directed towards the latter. In either case it turns to the median line again close to the posterior wall of the uterus-sac, and then passes over the ovarian isthmus and into the "generative space" where it expands, as it courses ventrally again, to form a receptaculum seminis.

The structure of the vagina is quite comparable, on the whole, to that of the vas deferens. Posteriorly it is lined with a syncitial epithelium, supported by an indistinct basement membrane which is relatively somewhat thinner than that of the vas deferens of the same proglottis, excepting in the region of the receptaculum seminis (vide infra). This is doubtless due to the fact that during the period of differentiation of the two tubes from the middle and narrower portion of the common anlage of the genital ducts, the vagina is somewhat in advance of the vas deferens, that is, it develops a lumen slightly previous to the formation of one in the latter, and then, evidently keeps in advance of it during subsequent growth and distension. From a point opposite the anterior end of the uterus-sac to its opening the vagina is lined with a cuticle which in many cases is lacerated and torn, especially at the surface next to the lumen. In this region, at the proper stage, that is, about the time when only a few eggs appear in the uterus-sac, what was considered by the writer to be the transformation of the epithelium into the cuticle can be observed much more clearly than in the case of the cirrus where only a comparatively short length of duct develops a cuticle. This seems to be brought about almost wholly by the sinking of the nuclei into the surrounding mass of cells derived from the outer layers of the anlage and lying outside of the basal membrane and circular muscles, and by the subsequent alteration of the epithelial substance to form the homogeneous cuticle. Very few nuclei in their passage through the membrane were seen, since no lengthy study of this subject was undertaken and since, as suggested

by Schaefer the process takes place, in all probability, quite rapidly, thus rendering the finding of the nuclei in all of the stages a matter of some difficulty in a comparatively small number of series. Three figures are given, however, to illustrate what was observed by the writer in this connection. Fig. 39 is a photograph of a coronal section through the first portion of the vagina, the entrance to the vagina being shown at "v". The latter is seen to be surrounded by a number of radiating cylindrical cells with rounded peripheral ends towards the parenchyma, somewhat resembling the cells of the subcuticular layer. They are much more numerous around the enlarged portion of the vagina than around the duct farther back. At "x" one of these elongated cells, with the nucleus situated at its extremity, is attached to the cuticle tangentially and in such an intimate manner as to lead one to think that it still functions, possibly, in the formation of the latter. Again at "x" and "y", Fig. 40, two nuclei with the surrounding cytoplasm appear to have passed through the basement-membrane but to have gone only a short distance beyond it. A similar case is shown in Fig. 41 at "y", while at at the point marked "x" a nucleus half way through the basement-membrane is to be seen. As the nuclei pass through the latter they are surrounded in many cases by clear areas, possibly cytoplasm quite thin in consistency, as noted by Schaefer in *Bothridium pithonis* Blain. Thus it appears—to the writer, at least—that, in the transformation of the epithelium of the distal portions of the vagina and vas deferens into the cuticle, the nuclei of the former pass into the surrounding parenchymatous tissue, and may there function in the formation of the latter. While the above evidence is scarcely to be considered as conclusive, it is given in the hopes that it will be at least suggestive to the reader in connection with the question of the formation of the cuticle in cestodes, which is again occupying the attention of helminthologists.

The musculature of the vagina is composed of circular fibers only, as in *Cyathocephalus truncatus* (Pallas), which are situated immediately outside of the basement-membrane. Very few of them surround the greater part of the canal, including its anterior enlargement, but a comparatively large number are developed in the short region between the latter and the opening to form a powerful sphincter, 30 to 40 μ in length.

From a point opposite the posterior end of the uterus-sac and ventral to the uterine tube ("Uteringang") the vagina gradually enlarges as it passes dorsally over the ovarian isthmus to form the r e c e p t a c u l u m s e m i n i s. The posterior, rounded end of the latter is situated within the generative space dorsal to the oocapt, with its longitudinal axis almost vertical (Fig. 27). The diameter of the tube at this point varies from

30 to 45 μ, depending on the amount of its distension with sperms. The receptaculum seminis is lined with a direct continuation of the syncitial epithelium of the vagina, in which, however, some tendency to form cell-boundaries appears, especially in the earliest stages. No valve-like modifications of the wall, as described by some authors for this part of the vagina of other species, were seen; there is simply a gradual enlargement of the duct up to the sudden constriction about to be mentioned. Furthermore, although the epithelium of the vagina and receptaculum seminis shows in many cases fine processes of different sizes, directed towards the lumen, these were not considered to be cilia, since, in the same regions of the other proglottides of the same chain, the epithelium was quite smooth and bounded by a more or less distinct membrane. There are few circular muscle-fibers surrounding the receptaculum seminis until a point is reached, immediately ahead of the constriction which bounds it proximally. Here they are greatly augmented and directly continuous with a well-developed musculature which surrounds the beginning of the spermaduct (Fig. 26). This musculature is evidently developed for the purpose of passing along, by swallowing movements, only a few sperms at a time, as indicated in the drawing which shows a string of sperms connecting the mass in the center of the receptaculum with the spermaduct. The latter in all such cases is filled with spermatozoa.

Immediately behind and ventral to the receptaculum seminis the vagina narrows down abruptly to form the s p e r m a d u c t. While its first portion, as indicated in Fig. 26, is very small, being only from 5 to 10 μ in diameter, it soon enlarges to almost twice that diameter, the size which obtains throughout the rest of its course. On account of the intense staining powers of the surrounding musculature it is very difficult to ascertain the nature of the wall at this level; however, it is composed of a very thin epithelium in which no nuclei were seen. On the other hand, certain nuclei situated outside of the basement-membrane and connected with it by cytoplasmic strands, on the whole reminding one of the radiating cells surrounding the cirrus and the entrance to the vagina, may possibly have been located within the epithelium at an early stage in development. Some of them are obviously the myoblastic nuclei of the circular muscles. To determine the exact origin of these nuclei it would be necessary to make a special study of the development of the ducts of the generative space, since the musculature of the spermaduct arises very early, even before some of the other ducts in the immediate neighbourhood are completely differentiated. The circular fibers diminish in number throughout the remainder of the duct, but are much more numerous than the few longitudinal fibers, arranged somewhat spirally outside of them.

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The ovary is an annular or closed horseshoe-shaped organ, situated ventrally at the posterior end of the middle field of the proglottis (Fig. 17). Although in most cases it appears to be completely closed posteriorly, it is in reality made up of two limbs,—they can be distinguished as such in the very young stages of development—connected anteriorly by an isthmus, on the ventral side of which is situated the oocapt. The limbs themselves are generally enlarged anteriorly, so that, on the whole, they somewhat resemble those of *D. latus*, which are, however, widely separated behind (Sommer and Landois). The organ is surrounded by a very thin wall and is divided by a continuation of the same into a number of irregular, tubular compartments which accommodate the ova. Scattered throughout these partitions and the outer capsule itself, very small, flattened nuclei, from 1 to 2μ in diameter, are to be seen. This description applies to all of the ovary, excepting that portion of the isthmus lying quite near the oocapt. Thus, from the fact that the isthmus—with the contained ova—is solid, it would appear that the views of Sommer and Landois and not those of Leuckart, who considered the isthmus or "bridge" to be a mere duct-like portion of the organ for the passage of the ova, are applicable to this form.

The largest ova (Fig. 28a), which appear in the ventral part of the isthmus and are thus ready to be passed on for fertilization by the oocapt, vary in longitudinal diameter, since the cytoplasmic outline is somewhat irregularly oval, from 10 to 12μ. The greater part of the comparatively large nucleus, which is about 7μ in diameter, stains much less deeply with Heidenhain's Iron-Haematoxylin than does the surrounding protoplasm; the "nucleolus", on the other hand, comes out extremely dark blue. With Mallory's stain, however, it appears orange, which colour is seen in no other part of the body. Consequently, the nucleolus seems, from its staining powers, to be a definitely functioning body and not a mere aggregation of nucleoplasmic particles. Yet such aggregations, quite as large as the nucleolus itself, are to be seen in other parts of the nucleus; so that from this and the further fact that the outline of the nucleolus is very often irregular, it is a matter of conjecture as to what is the true nature of the body in question. In the cytoplasm of many ova small clear areas, often provided with darkly staining bodies resembling nucleoli, are to be seen (Fig. 28b and c). Some of these may be nuclei forming in the protoplasm *de novo* (after Young's views), but others so closely resemble small free ova as to lead one to think that they may be abortive ova which have come into intimate contact with the cytoplasm of the normal ova and been subsequently absorbed by them, stages in the process of which absorption are probably represented in Fig. 28c.

The oviduct begins on the ventral surface of the ovarian isthmus with the oocapt which is a broad funnel-shaped or hemispherical structure directed ventrally in the median line (Fig. 27). The diameter of the latter, using the outer limits of the circular musculature as the boundary, since the organ is very gradually continuous with the wall of the isthmus, varies from 15 to 25μ. It is lined with a cuticle-like substance, which shows no nuclei for a short distance, and is surrounded by a system of circular muscles, arranged and extended quite like those of the spermaduct and posterior end of the receptaculum seminis. Furthermore, the resemblance in structure is the more exact from the fact that the constricted portion of the duct, which immediately follows the muscular funnel, is surrounded by radially arranged nuclei, many of which belong, of course, to the myoblasts of the circular fibers. The constricted part has a diameter of from 8 to 9μ; after which the oviduct gradually enlarges to 15μ, as it courses to the right or left and posteriorly until it meets the spermaduct almost in the median line of the proglottis. The wall is made up of a ciliated epithelium, in which are to be seen one layer of nuclei but no distinct cell-boundaries in the somewhat vacuolated cytoplasm, supported by a well-developed basement-membrane.

A short distance from its union with the spermaduct the oviduct is joined by the short duct from the yolk-reservoir. Just behind this point there is a slight constriction, around which the circular muscles are augmented in number to form a small sphincter while they are accompanied by a few longitudinal fibers.

Two vitelline ducts, each about 6μ in diameter, collect yolk from the lateral fields of vitelline follicles and pass towards the median line to unite either within or outside of the generative space ventral to the ovary. Union within the latter is the usual arrangement, in which case each duct is accommodated in the groove situated on the ventral surface of the ovary between the oocapt and the anterior end of the limb on each side. Each of these ducts may receive material from a few follicles on the opposite side of the proglottis, but, in general, it collects from the same side to which it is directed. Their walls are composed of a thin epithelium, showing small flattened nuclei distributed at wide intervals, on the whole resembling those of the vasa efferentia. Their courses are easily followed by observing the, in many places, greatly extended yolk-cells on their way to the yolk-reservoir (Fig. 29b.). On the other hand, the arrangement and structure of the smallest ducts in immediate connection with the yolk-follicles were not determined to the writer's satisfaction, since the latter are packed so closely together; but from various appearances they seem to anastomose.

The common duct, which is quite short (Fig. 27), is slightly larger than the collecting ducts, and its epithelium contains relatively more nuclei. It is furthermore provided with cilia, directed towards the yolk-reservoir.

After passing for a short distance dorsally and towards either side of the proglottis, depending on the arrangement of all of the ducts in the generative space, this common yolk-duct expands into the vitelline reservoir, an ellipsoidal or somewhat spherical sac varying from 25 to 55μ in diameter according to the amount of yolk it contains. Even when yolk is absent, however, it is larger than the common duct and shows very few cilia; thus it seems to be a true reservoir, in that it is possibly differentiated early in development, and not a mere temporarily functional dilatation. The epithelium is naturally considerably distended and flattened by the contained yolk. The reservoir unites with the oviduct through a short length of common vitelline duct whose structure is identical with that of the above-mentioned portion.

The vitelline follicles, like the testes, are situated in the medullary parenchyma, that is, within the longitudinal muscles and consequently within the nerve-strands (vide supra), thus resembling, as to situation, those of the genera, *Ancistrocephalus* Montic., and *Anonchocephalus* Luehe, (Luehe, '02). There they form a continuous cylinder from one proglottis to the next, enclosing the excretory ducts and reproductive organs, including the testes, but broken ventrally and dorsally by middle fields corresponding in extent to the region occupied by the generative ducts, that is, from the anterior end of the cirrus-pouch to the posterior end of the ovary (Figs. 17, 18 and 19). Posteriorly they crowd the ovarian limbs very closely, a few even passing above and below their hinder ends. Thus, in extent, the vitelline follicles are comparable to those of *Cyathocephalus* (Kraemer '92), *Schistocephalus* (Kiessling '82), and *Bothriocephalus dendriticus* Nitzsch and *B. ditremus* Crep. (Matz '92), excepting that in the three latter forms the dorsal middle-fields are occupied by them, while in the first genus neither dorsal nor ventral middle-fields are left free of follicles. In *D. latus*, on the other hand, both fields accommodate no vitelline follicles (S. and L. '72).

The follicles themselves are usually spherical to ellipsoidal in shape; but in ripe joints, where they are very closely packed together, the outline is somewhat polyhedric. Furthermore, they vary greatly in size, the smallest being only about 8μ in diameter, while the largest, which are more numerous, are even 50μ. The yolk-cells also vary in size, being from 5 to 15μ in length, obviously owing to their relative states of maturity. This is shown in Fig. 29a, which also gives some idea of their variety of outline. The latter, however, seems to be the result of the accommodation of a number of semi-fluid bodies within a fairly tense

membrane—the yolk-cells within the follicular wall. That the yolk-cells are semi-fluid in consistency cannot be doubted when one observes them in their passage through the vitelline ducts, as noted above in connection with the description of the latter, and as shown in Fig. 29b, where the nucleus with its surrounding clear area is distending the wall of the duct. The nucleus and, for that matter, the whole cell in many cases, resembles that of the ova; in fact, it is often quite difficult to decide which is the ovum in the egg-complexes to be found in the uterine tube. In most follicles the smaller cells are arranged around the wall more or less like an epithelium, as described by Sommer and Landois for *D. latus*, while the larger ones are to be found in the middle. The wall itself is a very thin membrane in which no definite nuclei were seen, although small flattened nuclei situated between the yolk-cells and close to the wall may belong to it. Perhaps the most noteworthy peculiarity of the yolk-cell is the large almost clear area to be seen in the cytoplasm, often surrounding the nucleus (Fig. 29), which is doubtless the fluid yolk which will later be absorbed by the developing egg.

A short distance from the point where the oviduct receives the common vitelline duct are located the s h e l l - g l a n d s . Here the oviduct expands slightly—to a diameter of 20μ. In most of the series examined the shell-glands formed a sort of vacuolated meshwork, in which, although there were to be seen well-developed nuclei, 4 to 5μ in diameter, it was extremely difficult to distinguish individual glands. However, in one series, where quite a length of oviduct was cut longitudinally, two or three club-shaped unicellular glands could be made out (Fig. 30). Their connections with the former were in the form of darkly-staining bars traversing the epithelium between lighter areas of about the same widths. Furthermore, numerous thread-like processes situated in the lumen, of the oviduct and directed towards the uterine tube corresponded with these dark bands, at least in position, since they were divided into groups, each group being opposite a dark band, as shown in the figure. While the outlines of the glands are quite difficult to discern, their connections with the oviduct are readily seen in sections through the region in almost any plane, tangential sections, for instance, showing dark circular spots on a much lighter background. Again, in younger proglottides treated with Mallory's stain, the glands and the otherwise dark bands appeared much lighter than the epithelium, which fact further supports the view that they are related anatomically. Thus, from the foregoing description, it appears that the processes in the lumen probably constitute the material secreted by the glands, and that this material is passed along from the bodies of the cells through the narrow necks which act as ductlets, suggestions which are strengthened by the facts that the so-called

secretion is to be seen mostly opposite the glands and that the ductlets have very thin but distinct walls.

The uterine tube ("Uteringang") is usually considered to commence immediately beyond the shell-glands, but in this species its first portion so closely resembles the oviduct posterior to the latter that the writer is inclined to place the region of demarcation somewhat farther ahead. The circular muscles are better and more uniformly developed, but what appears to be a decided augmentation in the number of cilia is probably a continuation of the threads of material secreted by the shell-glands. While the shell-gland region of the tube is directed dorsally, anteriorly and generally to the right of the proglottis, the beginning of the uterine tube makes a sharp turn and then passes backward again or expands immediately into what might be called the second division of the uterus, (Fig. 27). But this is not the second division of the uterus according to Braun ('00), since he does not seem to recognize in the "Uteringang", or uterine duct, two divisions, differing histologically; his second division is the uterus-sac, or "Uterushöhle". In this species it is in the form of a tube from 25 to 55μ in diameter, the walls of which are very thin and composed of a greatly extended epithelium in which quite flattened nuclei appear at irregular intervals. Commencing in the dorsal portion of the generative space, it courses forward in the median line above the ovarian isthmus as a somewhat flattened spiral, and in ripe proglottides often narrows down appreciably before entering the uterus-sac tangentially. It is usually filled with young eggs, each composed of many yolk-cells surrounding the "egg" (fertilized ovum) or a small number of cells resulting from the first divisions, all enveloped by a thin shell. In development the uterine duct is quite similar to the other ducts, possessing in the earliest stages a syncitial epithelium developed from an axial strand of cells surrounded by another layer of several cells in thickness, between which the basement membrane appears.

The uterus-sac ("Uterushöhle") arises in the same way from the middle piece of the elongated anlage (Figs. 15 and 16), but is from the outset distinctly separate from the uterine tube, the latter opening into it dorsally and slightly ahead of its posterior end. Beneath this opening the uterus-sac sends a diverticulum ventrally to the point where the aperture will later appear, while the remainder of the organ is directed forward in the median line some distance from the ventral surface, at first as a narrow tube, later as an elongated sac (Fig. 10). At this stage the wall of the uterus resembles, in general, that of the generative ducts. It is composed of a syncitial epithelium with scattered nuclei, a well-defined basement membrane, and outside of the latter a thin layer of parenchymatous cells. All of these parts are thinned out considerably

with growth, so that eventually, in gravid joints, the wall appears as a very thin membrane, showing practically no structure (Fig. 19). In slightly younger stages than that shown in Fig. 17 the lumen is not so uniform in outline, since its anterior half is divided into shallow evaginations, somewhat comparable to those seen in the uteri of the species of the order *Tetraphyllidea*. These soon become obliterated, however, the inside of the wall in gravid conditions begin quite smooth.

The opening of the uterus-sac, situated, as shown in Fig. 10, towards its posterior end, seems to function for a short time only, since in the longest strobilas no trace of it was found near the end of the chain. In the middle region, on the other hand, it appears as a very narrow slit, about 0.1 mm. in length, in only a few proglottides. Furthermore the uteri in which these openings are to be seen are generally almost free of eggs, as if the openings had been used for the dispersal of the eggs in the usual manner among the Bothriocephalids, while those behind the region in question are tensely filled. These facts would lead one to think that in most proglottides the eggs are freed by the rupture of the uterus and the body-wall, as in the higher cestodes, beginning with the *Tetraphyllidea*, while the uterine aperture either functions for a short time only or in proglottides, probably more or less constant in number and location. Fig. 31a is a view of the opening drawn from a transparent preparation in the uterus of which were comparatively few eggs. It is seen that the slit is surrounded by a clear area beyond which there is a more deeply-staining region. The latter is in reality made up of radially arranged nuclei which are related to the clear area in a manner better shown in coronal sections of stages prior to the breaking through of the slit (Fig. 31b). Here they are seen to be connected with the dark line, where the slit will appear later, by fine striations which continue farther out into the surrounding cytoplasm. Whether these radiating nuclei form a glandular organ around the aperture or give evidence of a migration from the clear area which remains as a cuticular rim, is difficult to say; but, from the close resemblance to the structure of the cirrus and of the entrance to the vagina, the writer is inclined to the latter view.

Development of the fertilized ovum, which begins, as mentioned above, in the uterine duct proceeds in the uterus-sac, eggs, bearing oncospheres, being obtainable from proglottides situated towards the posterior end of the strobila.

The e g g of this species is an ellipsoidal structure, from 60 to 70μ in length and from 40 to 43 μ in breadth. The shell is uncolored and perfectly transparent, so that the contents can be observed quite easily (Fig. 32). It is lined by a very delicate membrane which, however, can be seen only when it is, in some cases, separated from the former (Fig. 33).

The embryo is composed of two portions, an inner, the oncosphere, and an outer, the mantle or so-called ectodern, well supplied with cilia. The movements of the latter can be seen even when the embryo is within the shell, especially if a little pressure be applied to the cover-glass. In this case they vibrate so vigorously that the whole embryo is driven to the larger end of the egg, and numerous, supposedly vitelline granules, are kept continually in motion, and, at the same time, arranged in two groups, one close to the mantle and, to all appearances, among the bases of the cilia, and the other in the smaller posterior end of the egg. The shell is provided at its anterior end with a well-defined operculum, the raising of which, evidently due to the pressure from within, permits the escape of the embryo. This, however, is a somewhat difficult matter on account of the size of the latter, as can be seen from Fig. 33. As fast as the cilia are freed they proceed to vibrate strongly in the surrounding saline solution, and as soon as the embryo has escaped from the shell it swims away quickly, taking either straight courses or moving about erratically in irregular curves. It was also noticed that the cilia are all directed posteriorly from what might be called the apex of the body, both within and without the shell,—posteriorly, since this apex is anterior, not only from its direction during motion, but from its being situated at the end of the oncosphere opposite to that which accommodates the hooks. While the mantle is comparatively constant in size, its diameter being about 45μ, the oncosphere varies from 30 to 35 μ in length. Practically no structure was observed in the substance of the mantle itself. The oncosphere, on the other hand, shows the usual three pairs of hooks, a pair of flame-cells and a few spherical bodies of doubtful significance (Fig. 32). The movements of the hooks and of the body of the oncosphere are quite typical. They take place even when the embryo is yet within the shell, but, as has been verified in many preparations, only when the whole egg has been stimulated by pressure, in which case they are quite irregular and necessarily considerably restricted. They are perhaps a little freer when the embryo, including the ciliated mantle in situ, is liberated. At rest the three pairs of hooks are arranged, as shown in Fig. 32, in the form of a tetrahedron, the apex of which is situated at the center of the oncosphere while the base is directed posteriorly. From this position the peripheral ends of the hooks approach each other until they are quite close together, while the central ends diverge towards the bounding membrane of the oncosphere. This causes a slight retraction of the tip of the latter. Then follows a comparatively vigorous separation of the hooks, to the extent that their outer ends are about 180° apart while the inner are close together. At the same time the individual hook protrudes from the surface of the

oncosphere up to the small process, situated a short distance from its tip (Fig. 32). This process and the slightly swollen central end of the hook seem to act as bases of attachment for what appears to be a well-developed musculature actuating them. The hooks again approach and the whole cycle is completed. In the most vigorous specimens these movements take place at the rate of about three per minute. As might be expected, the slightly smaller anterior end is much affected by the movements of the other end; however, it exhibits movements of its own, consisting of small waves of contraction commencing at the inner ends of the hooks and passing forward, thus in a direction opposite to those seen in the plerocercoid and in the young strobila.

Concerning the life-history of this species nothing can be offered at the present. It was only noticed, as mentioned at the outset, that plerocercoids a few millimeters in length were found in the intestine of the host along with the largest strobila taken. The food of *Amia calva* consists, however, evidently entirely of small fish, mostly minnows, and it is possible that one or more species of these are the intermediate hosts.

SUMMARY.

The form of the body of this worm is peculiar in that proglottidation is expressed externally only in the anterior end of the strobila, beginning immediately behind the scolex. Here the proglottis is provided at its hinder end with four ear-like appendages directed posteriorly, which, in conjunction with their fellows of the neighbouring joints, may act as important accessory organs of attachment, perhaps by forming temporary suckers or using certain rows of spines, arranged around their edges, to obtain a hold on the mucous membrane of the host's intestine. Posteriorly these appendages disappear, leaving no indication of proglottides apart from the sets of reproductive organs which follow each other at regular intervals in the usual manner.

The scolex differs little internally as well as externally from the foremost joints, the two bothria or suckers being comparatively feebly developed.

The musculature is particularly well expressed in the jointed region of the strobila which is consequently the most mobile. All of the usual groups of muscles to be seen in Bothriocephalids are present, the external longitudinal fibers being quite distinct from the inner or longitudinal muscles of the parenchyma but confined to the anterior end only of the strobila, while the outer transverse series is divided into two sets on each surface of the proglottis, the fibers of which are directed postero-laterally and thus made to decussate in the mid-line. The individual fibers of nearly all of the groups of muscles are characterized by having their

cortical or contractile layers divided up into a number of fibrils, which, however, still retain their connections with the protoplasmic substance of the myoblasts.

The nervous system consists of two chief strands, situated laterally in the medullary parenchyma ("Markschicht") and united beneath the tip of the scolex to form a very small ganglionic ring. Connected with these are eight collateral strands, four located around each chief strand, which appear in the jointed portion of the strobila only.

The excretory system is composed of one large median vessel,—the equivalent of the usual dorsal pair—and two smaller, situated laterally and ventrally. All of these unite in the scolex to form a median vesicle accommodated in the hollow behind the nerve-ring. Foramina secundaria and flame-cells are fairly numerous, but their connections are difficult to trace.

The genital organs are simple, on the whole resembling those of *Dibothriocephalus latus* (Linn.). The genital apertures are all situated on the ventral surface in the median line, that of the vagina close behind the cirrus-opening towards the anterior end of the proglottis, that of the uterus much farther back and evidently a temporary aperture only. There is no distinct genital atrium or cloaca.

The testes are all in one plane and separated into two lateral fields by the median excretory vessel. Opposite the genital ducts both testes and vitelline glands separate dorsally and ventrally to leave clear "middle fields". The vas-deferens, which courses in the median line dorsal to the uterus-sac, is provided, at its posterior end near the middle of the proglottis, with a sperm-reservoir, and with a large almost spherical seminal vesicle situated immediately behind the cirrus-pouch. The latter is spheroidal in shape, simple in structure, and contains the continuation of the vas-deferens, divided into three regions, an ejaculatory duct, a second seminal vesicle and the cirrus. The cirrus is lined with cuticle in which there are small stout spines and around which there is a series of well developed circular muscles.

The vagina, the entrance to which is also lined with cuticle and supplied with a sphincter muscle, courses ventrally and expands within the "generative space" to form a seminal receptacle, sharply separated from the very small and short continuation, the spermaduct which unites with the oviduct in the usual way. The ovary and shell-glands are median and respectively ventral and dorsal. The yolk-glands are composed of numerous follicles, arranged cylindrically around the testes,—both within the longitudinal muscles of the parenchyma. There is a large yolk-reservior, situated in the generative space. The uterus is divided into two distinct portions from the earliest appearances in the

common genital anlage, a much-coiled, proximal, thin-walled tube, the uterine tube ("Uteringang"), and a capacious uterus-sac ("Uterushöhle") which, when gravid, occupies almost the whole of the central portion of the proglottis. The eggs are provided with opercula.

All of the genital ducts are lined with an epithelium which, on account of cell-boundaries being almost entirely absent, is of the nature of a syncitium. In certain regions, namely, in the cirrus and in the entrance to the vagina, this syncitial epithelium becomes transformed into cuticle with an accompanying migration of its nuclei through the basement-membrane and into the surrounding parenchymal cytoplasm.

From the foregoing description it is to be seen that, although this species is in most respects a typical Bothriocephalid, its characters are such as to render the placing of it in the existing classification of the families and genera of the order, Pseudophyllidea, a matter of considerable difficulty. However, since this subject is dealt with in another paper, as mentioned at the outset, it will be sufficient to state here that, so far as the writer has been able to ascertain, this is a new species of cestode which must also be accommodated in a new genus. Consequently, the following names are proposed: Genus, *Haplobothrium* (ἁπλοῦς, simple; βοθρίον, a small hollow or trench); species, *globuliforme*, (*globulus*, a bead; *forma*, shape or form), the significance of which specific name has been referred to above.

The type-specimen of this species is included in the writer's private collection, while a co-type has been donated to Dr. H. B. Ward of the University of Illinois.

Biological Department,
University of Toronto,
August, 1914.

EXPLANATION OF FIGURES.

All of the figures are camera-lucida drawings, excepting Figs. 34 to 41, inclusive, which are photomicrographs of sections or portions of sections.

c, cirrus.
ccm, circular cuticular muscles.
cm, coronal muscles.
cmc, circular muscles of cirrus.
cn, collateral nerves.
cu, cuticula.
cub, cuticula of cirrus.
D, dorsal.
g, ganglionic ring.
ivs, second vesicula seminalis.
lev, lateral excretory vessel.
lmp, longitudinal muscles of parenchyma.
mev, median excretory vessel.
n, nucleus.
olm, outer longitudinal muscles.
pc, cells of parenchyma.
rmp, retractor muscles of cirrus.
rs, receptaculum seminis.
rvd, right vitelline duct.
sc, cells of subcuticula.
sg, shell-gland.
sr, sperm-reservoir.
t, testes.
us, uterus-sac.
ut, uterine tube.
V, ventral.
v, vagina.
ve, vas efferens.
vf, vitelline follicles.
ns, nerve strand.

PLATE V.

Fig. 1. Scolex and first three proglottides, × 32.
Fig. 2. 12th, 13th and 14th proglottides, × 8
Fig. 3. Proglottides 20 to 25, inclusive, coronal view, × 8.
Fig. 4. Same, laternal view, showing disappearance of auricular appendages, × 8.
Fig. 5. Young "scolex," showing beginning of proglottidation, × 16.
Fig. 6. Smallest plerocercoid observed, × 16.
Fig. 7. Longitudinal section through the cuticle and subcuticle: *cu'*, outer and *cu''*, inner layers of the cuticle; *fs*, foramen secundarium of the excretory system; *bm*, basement membrane; *lcm*, longitudinal cuticular muscles, × 1600.
Fig. 8. Longitudinal section through the tip of an appendage, showing the minute spines, × 1500.
Fig. 9. Relations between myoblasts and muscle-fibrils: a, coronal fiber; b, c and d, myoblasts of longitudinal muscles of the parenchyma, × 1500.
Fig. 10. Transverse sections of muscle-fibers: a and b, from the external longitudinal series of the parenchyma; c, from the dorso-ventral group, actuating the bothria; *f*, fibrils, × 1500.

Fig. 11. Reconstruction of the nervous system in the scolex and anterior proglottides, × 40.

Fig. 12. Coronal section of the "end-proglottis", showing the relations of excretory vessels; *cv*, dilatation of the median excretory vessel, × 150.

Fig. 13. Flame-cell: *bb*, basal body; *cf*, cilliary flame, × 300.

Fig. 14. Transverse section of a lateral excretory vessel in the posterior end of the scolex: *bm*, basement membrane; *dvm*, dorso-ventral muscles, × 1100.

Fig. 15. Proglottis 16 of a strobila, showing very early stage in the development of the reproductive organs: *agd*, anlage of the genital ducts, × 37.

Fig. 16. 17th proglottis of same strobila, × 37. Figs. 15 and 16 are drawn from oil-of-cedar transparencies.

Fig. 17. Transparent preparation of a mature proglottis,—testes and vitelline follicles not complete: *vs*, vesicula seminalis; *vd*, vas deferens; *cp*, cirrus-pouch; *co*, cirrus-opening; *vo*, aperture of vagina; *uo*, opening of uterus; *ov*, ovary; × 60.

Fig. 18. Transverse section through the interproglottidal region of the unjointed portion of the strobila, × 130.

Fig. 19. Same through the middle of the proglottis, only two eggs shown in the gravid uterus-sac, × 130.

Fig. 20. A single testis with its vas efferens: *cyt*, cytophore, × 365.

Fig. 21. Sperm-reservoir at the posterior end of the vas deferens, × 365.

Fig. 22. Anastomos of vasa efferentia near the sperm-reservoir: *m*, median line of the proglottis, × 200.

PLATE VI.

Fig. 23. Cross-sections of vas deferens: *ev*, syncitial epithelium; *mcm*, myoblasts of circular muscles, × 1000.

Fig. 24. Cross-section of cirrus, × 500.

Fig. 25. Cross-section of younger cirrus, × 500.

Fig. 26. Longitudinal section of receptaculum seminis and first portion of spermaduct: *s*, sperms; *sd*, spermaduct, × 235.

Fig. 27. Genital ducts in the generative space, posterior view of a reconstruction: *cvd*, common vitelline duct; *od*, oviduct; *sd*, spermaduct; *oc*, oocapt; *yr*, yolk-reservoir, × 60.

Fig. 28. Ova, showing accessory cells in connection with two: *ac*, accessory cells; *cy*, cytoplasm, × 1000.

Fig. 29. Individual yolk-cells: a, from follicles; b, from a collecting yolk-duct, × 1000.

Fig. 30. Longitudinal section of the shell glands; *eod*, epithelium of the oviduct, × 1000.

Fig. 31. The uterus-opening: a, from a transparency; b, from a coronal section before the formation of the aperture, × 100.

Fig. 32. The egg, showing contained embryo, × 500.

Fig. 33. Another, showing the escape of the oncosphere surrounded by the ciliated mantle, × 500.

PLATE VII.

Fig. 34. Photograph of a transverse section through the middle of the scolex: *ots*, outer transverse muscles; *b*, bothrium; *dvb*, dorso-ventral muscles of the bothria.

Fig. 35. Transverse section through the posterior end of one of the foremost proglottides: *app.* auricular appendage; *ldvm*, lateral dorsoventral muscles.

Fig. 36. Coronal section, slightly aside from the median line, through the scolex and first two proglottides: *ofs*, oblique fibres of the scolex; *cs*, cuticular spinules.

Fig. 37. Similar section, in the median coronal plane: *aev*, anterior excretory vesicle; *laf*, longitudinally arcuate fibers of the scolex; *mb*, bothrial muscles.

Fig. 38. Portion of a transverse section through the cirrus-pouch: *de*, ductus ejaculatorius; *wcp*, wall of the cirrus-pouch.

Fig. 39. Coronal sections through the vagina and its entrance, showing a migrating nucleus at *x*.

Fig. 40. Portion of a longitudinal section through the vagina, showing two nuclei at *x* and *y* leaving the epithelium.

Fig. 41. Another portion of the vagina, showing two nuclei passing through the basement membrane. Lettering as in the last figure.

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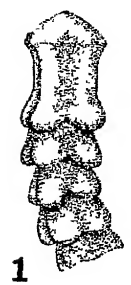

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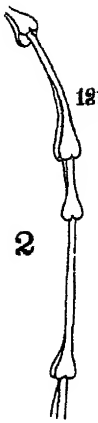

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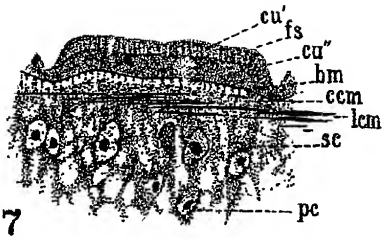

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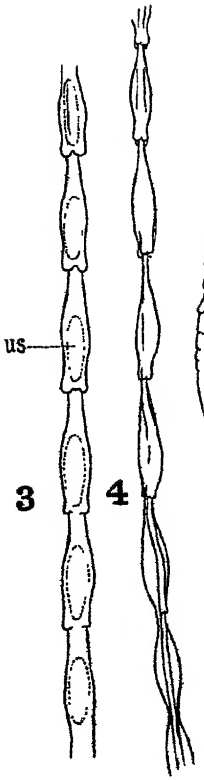

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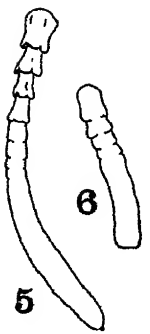

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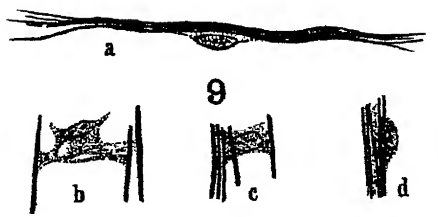

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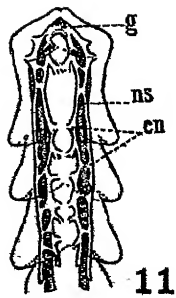

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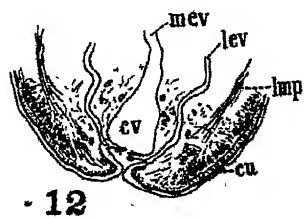

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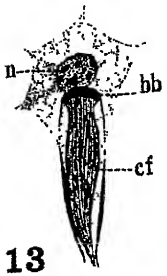

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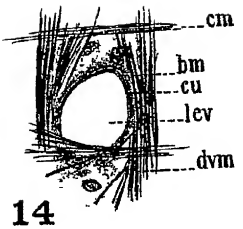

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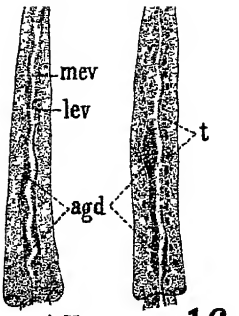

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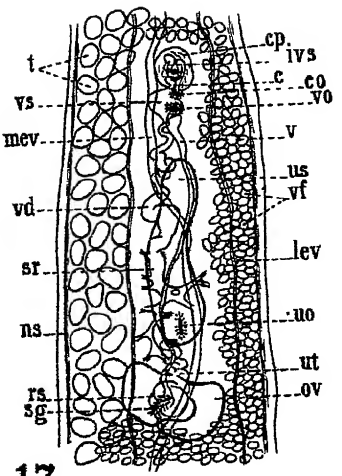

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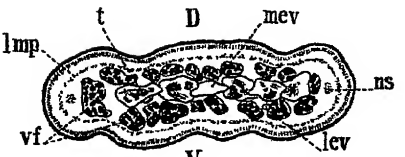

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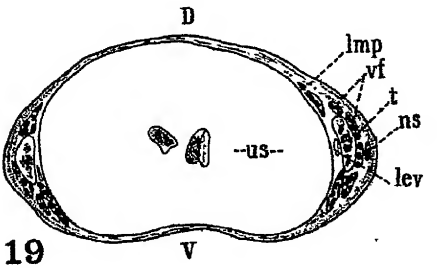

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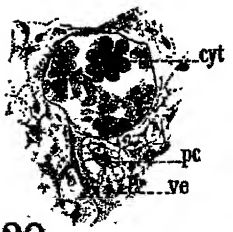

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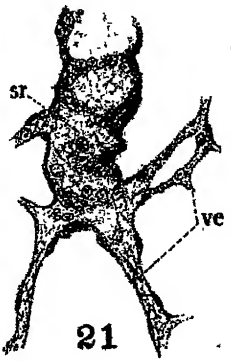

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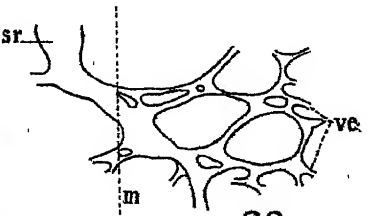

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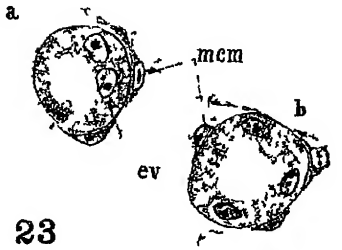

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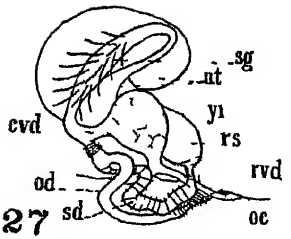

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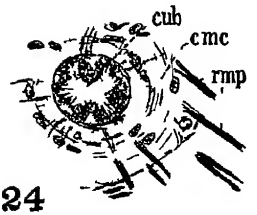

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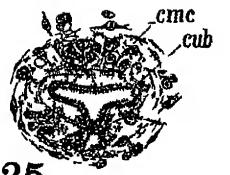

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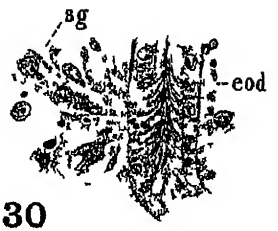

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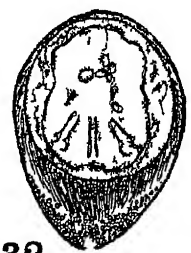

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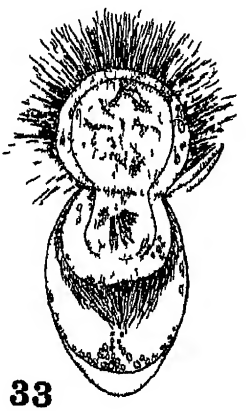

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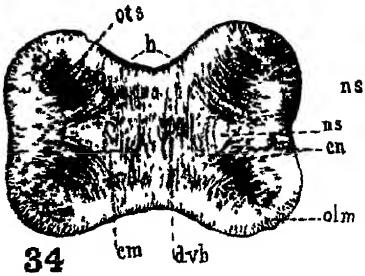

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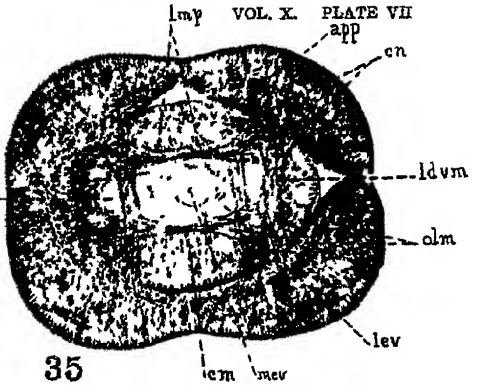

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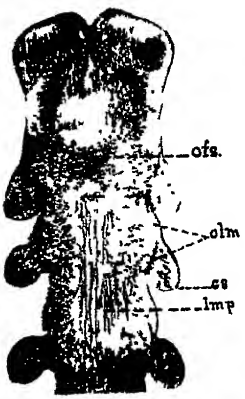

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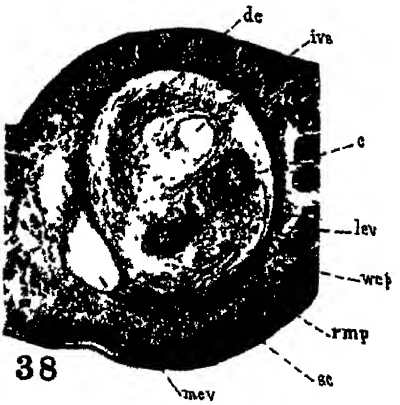

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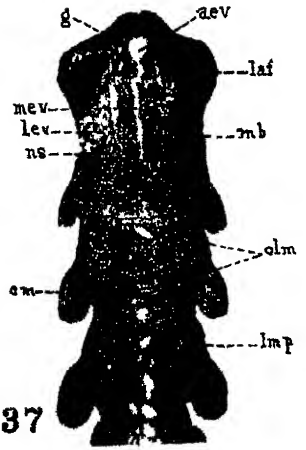

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THE EGG-LAYING HABITS OF *PLETHODON CINEREUS*

BY W H. PIERSOL, B.A., M.B.

(*Read 15th November, 1913.*)

Two accounts of the natural history of this, our commonest salamander, have appeared, one by Miss M. E. Cochran (1911) and one by the writer (1909). Both agree in their descriptions of the eggs, but neither gives any information as to the mode of deposition. The writer has sought to determine this by observations made on *Plethodon* both in its natural habitat and in a terrarium. The following is an account of the more important observations together with comment and inference. Fertilization is internal; this had been predicted in the earlier paper (1909) and has since been confirmed by the fact that a female isolated in a terrarium for four days laid eggs that developed naturally.

Case I. On one occasion the actual extrusion of the eggs was observed. The female had been placed when captured in a small glass jar along with fragments of the log in which she was found; and the jar with others containing eggs was carried back to the laboratory in a small bag. Chiefly for the sake of the eggs which are very delicate the bag was guarded from shocks as far as possible, then for another hour it stood unopened. On removing the jar from the bag it was seen that the egg laying had just begun, fortunately in such a position that all its details could be observed. The lips of the cloaca are pressed against the surface from which the eggs will eventually hang and a small quantity of mucus is extruded and adheres firmly to it. This much had been completed before observation began so nothing can be said as to the interval that then elapses before the first egg is laid. The extrusion of each egg occupies about twenty seconds and an interval of five to ten minutes occurs before the next appears. The first three eggs were laid in contact with the mucus above mentioned; the fourth, and last, adhered to them in turn through the stickiness of the egg-envelopes. As the female did not move during the entire process, all the eggs were laid at the same point, each egg as it came, crowding the preceding ones aside, thus making sure of being in contact with them. For over an hour after the last egg was laid the female did not change her position; during the next hour she left the eggs a few minutes, then returned and coiled herself about them.

The extrusion of the egg causes it to become elongated; the greater axis may be almost twice the less. In the case above noted the spherical form was assumed within a few minutes; in other cases the elongation has taken more than an hour to disappear. Exceptionally the elongated form may be retained for a considerable time. The most extreme case met with was an egg found among natural surroundings with the longest axis 5.25 m.m. and the shortest 2.75 m.m. In the same cluster was another elongated egg, its axes being 4.0 m.m. and 3.0 m.m. The three remaining eggs were spherical; all five were in the process of gastrulation. Another egg, quite similar to the one first mentioned was laid by a female in a terrarium; it kept pace in development with the remaining eggs of its cluster up to the 50-60 cell stage. In the first two cases the segmentation cavity had formed near one end of the long axis, in the third case near one end of a short axis. As the eggs were fixed at the stages mentioned it is impossible to say how the further development would have been affected.

This mode of egg-laying places *Plethodon* at the end of a progressive series, the most primitive member being Cryptobranchus, with eggs laid in a uniform rosary-like string as described by Reese (1904) and Smith (1906). Next, as suggested by Wilder (1913), would stand *Desmognathus;* in this genus most of the eggs have left the main string of the rosary and lie at the sides of it, each retaining connection with it, however, by a short stalk. The next step is represented by such a case as *Spelerpes* (Wilder, 1899) or *Antodax* (Ritter and Miller, 1899); here the disappearance of the main string leaves each egg to be attached separately to its support—usually a stone—by a short stalk. The disappearance of this stalk for each egg, except the first, produces the separate eggs of *Plethodon*. This economy of material is highly desirable in so small an animal. The position of *Antodax* in the series given above is not that usually occupied by the genus in a series that shows progressive modification of some primitive habit; in most respects *Antodax* has departed furthest from the primitive amphibian mode of life, and *Plethodon* can only offer suggestions as to the path along which *Antodax* has travelled to its present condition. In habits, however, as in morphology, it does not follow that the higher member of a series must in every point have progressed beyond the lower.

Other observations differing from the foregoing are as follows:

Case II. In examining a terrarium on one occasion there was uncovered a female that had evidently just completed the extrusion of the eggs. Two eggs, approximately spherical, were in contact and cohering slightly; four other eggs, each more or less elongated, were lying separated from each other by intervals of about one-quarter of an inch; none

of them were suspended. Evidently under the somewhat unnatural conditions the female had moved after the extrusion of each of the last five eggs. *Case III.* In picking apart a decaying log there were exposed on one occasion a female and four eggs. One of these lay by itself, markedly elongated; the other three were in contact, two of them somewhat elongated, the third apparently spherical. All four were lying on the floor of the cavity, which fortunately had been opened from the side. Examination of the female revealed the existence of four eggs in the posterior parts of the oviducts. Evidently the egg-laying process had been interrupted by the opening up of the nesting-chamber.

These last two cases have been selected from among a few of the same general character because they differ from the rest in that the eggs were not suspended. In opening up logs a few clusters have been found unattached. At first, in such cases, it was taken for granted that the opening up of the nesting-chamber had involved the loosening of the eggs. Since attention has been directed to the possibility of a cluster not having been attached, two such have been found under circumstances that would seem to preclude the idea of their having been torn from their attachment. In neither of these two cases could a stalk attached to the cluster be found. It would seem that occasionally the tendency to reduce the amount of material devoted to forming stalks for the eggs goes so far as to eliminate even the stalk of the first egg. No exact count has been kept of the number of such cases as compared with the normal, attached ones, but the impression left is that it is very small.

As might be concluded from *Case I*, an examination of the relation of the stalk to the eggs shows that it does not come from any one particular egg, but from a quantity of mucus that adheres to the outer envelope of certain of them; the impression given is that of a material poured onto the bunch, part of it being drawn out to form the stalk. As is the usual case among Urodeles the outer envelope of each egg is of a much more sticky mucus than the inner ones. Plethodon is peculiar in having this outer layer unusually thin, and in depositing a still more sticky mass of mucus before the egg-laying proper begins.

In most amphibia the impulse toward the deposition of the eggs, once these are ready for the act, is an imperative one. In some cases (*e.g.*, many frogs) the assistance of the male is needed, but generally speaking, when the proper time comes the spawn will be deposited even with conditions and surroundings that are far from natural. Both *Rana pipiens* and *Rana catesbiana* that have been kept over winter, without feeding, in a tank in the basement of the Biological Building of the University, have been known to spawn in spring and early summer respectively. (Such spawn has never developed, evidently has never

been fertilized.) In *Plethodon* the instinct is more delicately adjusted. This is shown in the marked preference for some particular log as a site for egg-laying. For instance, one small plot of woodland was found to contain *Plethodon* in abundance during the spring of 1913 and was visited on June 21st in the search for eggs. A dozen or more rotting logs yielded only males or sexually immature specimens; at last one log was found which, though apparently not differing from the others, yielded eleven females with eggs. A number of similar cases have been met with. The logs so greatly preferred are invariably conifers, but other factors must enter into the quest on for another coniferous log that seems quite similar may be close at hand yet be entirely destitute. Equally striking is the difficulty that has been experienced in getting females to lay eggs in a terrarium. The thin, almost translucent ventral wall of the abdomen allows the easy recognition of females containing eggs almost ready for deposition. If pieces of the logs in which the animals have been found are brought from the field and the pieces piled together in a terrarium so as to reconstruct roughly the log, there is no difficulty in keeping the animals alive and in good condition for long periods. They will feed readily on small insects, *e.g.*, aphids; but, like most amphibia, seem to suffer little from long deprivation. Three specimens overlooked in a small terrarium last spring lived until the end of September with no attention; at the end of that period their physical condition and vigor had suffered so little that they could not be recognised after being allowed to mingle with others brought in from the field. In spite of this apparent easy acceptance of life in a terrarium, the change usually is sufficient to inhibit the egg-laying reactions, and the eggs are retained and absorbed during the next five or six weeks. Exceptionally they will be laid as under natural conditions, but only when the female has been brought from the field not more than three or four days before the time for egg-laying. It is not a question of previous impregnation or its lack, for as far as examined, all mature females have been found to have the receptacles filled with sperm some time before the egg-laying season arrives.

The character of the season has some influence on the depth beneath the surface at which the eggs are laid; in damp seasons they will be for the most part but an inch below the surface, in dry seasons they will be four or five inches below. This refers to the character of the season up to the time of egg-laying, not after.

The retention of one egg in the ovary was mentioned in the earlier paper. Later experience has confirmed the observation. The egg is always much under-sized and occurs in about one third of the females accompanying clusters of eggs in early stages of development; it is then rapidly absorbed, and must have considerable value as a

supply of nourishment for the female during her wait by the eggs. Occasionally it will almost equal the remaining eggs in size and then will be laid along with them, producing a cluster with one markedly small egg. For example, in one cluster of seven eggs, six of them had a diameter of 3.75 m.m., the remaining one of 2.75 m.m. From a difference so marked as this there is a gradual transition to the state where all the eggs of the cluster are the same size; such are about one half of all cases. The writer has twice found similarly undersized eggs of *Amblystoma;* the numbers were small, nine and eleven in the two cases, and the eggs of but two-thirds the normal size. They developed normally, producing under-sized larvae which were perfect anatomically but defective in their feeding instincts. The one lot would not feed at all; the other would snap fitfully at *Cyclops*, etc., but would not eat enough to grow or even to maintain life. This was quite striking for both lots were the species *jeffersonianum* the larvæ of which are normally voracious feeders and easy to raise. In *Plethodon* the early development of the small egg is quite normal, its fate has never been followed past the time when the larva is well formed.

One female, kept in a terrarium with her eggs, swallowed two of them, and three hours later regurgitated them. The eggs were killed by the process, whether by digestive action or by the mechanical violence it is impossible to say, for they were in the process of gastrulation at the time. This is a most critical period for the egg, its delicacy is at the maximum and very slight disturbance will cause its death. The swallowing of their spawn has been noted for many amphibia, usually where, as above, something has happened to pervert the natural instincts. Smith (1907) however, describes it as normal for *Cryptobranchus;* in this case moreover when regurgitated the eggs frequently continue to develop.

Means taken to determine the mating habits have so far been fruitless. The single observation of Wilder (1913) on *Desmognathus* is probably a close approximation to the habits of *Plethodon* in this respect.

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ON THE DERIVATION OF CERTAIN PLACE-NAMES IN THE GEORGIAN BAY.

BY PERCY J. ROBINSON, M.A.

(*Read 14th February*, 1914)

It is proposed to consider the derivation of the following names:— Penetanguishene, Matchedash, Waubaushene, Cognashene, Minnacognashene, Waubic, Muskoka, Muskosh, Go-Home, Madawaska.

1. PENETANGUISHENE:

Peter Jones gives the meaning "cavings and bank"; Dr. Scadding, "the place of the falling sands"; Bonnycastle, "white rolling sands"; Another, "look it is falling sand".

Besides the spelling given above the form Penetangushene occurs in early maps. Kohl in "Kitchi-Gami" gives Penangouishing. Peter Jones states that the word should be pronounced, Pe-nuh-dau-wung-o-sheeng. Bonnycastle gives Pen-et-awn-gu-shene.

The derivation is as follows (chiefly on the authority of Captain Kelton): *Matawa* = "sand". The termination *ika* added to a noun means plenty or abundance, *e.g.*, *minika* = "plenty of berries" (*min* = a berry). *Matawangka* or *mitawanga* = "a sand bank". *—ashk* is a common termination meaning grass. So *mitawangashk* = "a grassy sand bank". *—ing* is a locative termination; *mitawangashking* = "place of the grassy sand bank". The first part of the word is from the root of the verb *pungeshin* "to fall". Hence *Puntawangashking*, "the place of the falling grassy sandbank". The disappearance of the initial syllable of *mitawanga* is an illustration of a common rule in the formation of compounds in Algonquin languages.

The meaning given by Bonnycastle would seem to connect the word with an Algonquin word *penud* "it is clear" instanced by Schoolcraft.

2. MATCHEDASH spelled also Matchedashk.

Either from Ojibway "*muchie*" or "*matchi*" = bad, and the termination *—ashk* = grass, alluding to the barrenness of the region to the north,

or from the Ojibway prefix *madji* meaning "a beginning", and the same termination *—ashk*, and so meaning a beginning of good grass alluding to the fertile lands to the south and west. J. Carruthers, writing in 1835, uses this name as a term for the marshy end of a bay. "Being carefully directed through the woods, and round the point of Kempenfeldt Bay, I got through this *Matchadash* (rushes, mud, and water), and safely landed in the open forest where the town of Barrie now stands".

3. WAUBAUSHENE. The same derivation as the river Wabash. The Indians called marshland *wabashkiki: wab* = white, *—ashk* = grass; *uhke* = land. The Indian name for Lake Erie was *Wabeshkegoo Kechegahme.* The ending *ene* is a corruption of *—ing*, the locative ending. Hence the word Waubaushene means "place of marshes".

4. COGNASHENE POINT. *Kawg* in Chippewa = "a porcupine". There was a gens of this name. *Kawgons* = "a little porcupine". Diminutives are very common in Algonquin languages. *Kawgonsing* corrupted to *Cognashene* = "place of the little porcupine".

5. MINNACOGNASHENE Island. This is plainly the same word, with the Algonquin word *menis* = "island" prefixed, a word sometimes abbreviated to *min* as in *Manitou-min.* The name may possibly be derived from *minika* "plenty of blue-berries", *minnesing* locative form of *menis* "island"; the first syllable being lost, as frequently in composition we get *minikannesing* which might in an English mouth become Minnacognashene.

6. WAUBIC. The name of an island and of the Northern Navigation Co's steamer is properly a suffix *waubek* = "rock." The word is also used by the Chippewas as the name for a dollar. This word is used in combination with the prefix *kewa* = "come back" to form the word *kebek*, an exclamation used by the Ojibways, according to Schoolcraft, when passing a narrow place in a river. He has suggested, no doubt correctly, that this is the derivation of "Quebec".

7. MUSKOKA is from *misquah* = red and *uhke* = earth, alluding to the prevailing red feldspathic rocks of this region. There was also an Indian chief of this name, Musquakie, who hunted in this region.

8. MUSKOSH, variously spelled, is the name of the river flowing out of Lake Muskoka through Go-Home Lake to the Georgian Bay. The name may be derived from *musqu-ahsin* = red stone, or *omushkoos* = "a buck". It may be the same word as the river *Mascouche* in Quebec, derived by some from the diminutive *maskus* = " a little bear". Very probably the name is derived from *musquash* = "a musk rat", a word noted by Sir Charles Head in 1814 in this region and still in use among fur dealers in Canada. This word has been derived by Prof. Chamberlain from *miskwasi* = "it is red".

9. GO-HOME. It has been suggested that this is a corruption of the Indian termination word—*gummee*="a lake". The name Go-Home is applied to a lake, a bay, and a river. The Indians do not recognise the word and translate Go-Home Bay *Kewawequad*, *kewa* being a prefix meaning "return", as in *Kewatin* "the wind that returns from the north"; *wequad*="a bay". The root of— *gummee* is found also in *agŏm*="I am in harbour"; *agŏmowin*="a harbour", etc.

10. MADAWASKA. This word is an alien in this region, coming hither from the Madawaska River, a tributary of the Ottawa on whose banks the University Club at first intended to settle. Various derivations are given in "Les Noms Geographiques de Quebec" by M. Roy. The most probable derivation is that suggested by Baraga, *madawa* or *matawa* ="sand"; *—ashk*="grass". And so it signifies meadowland at the mouth of a river.

NORTHWESTERN DÉNÉS AND NORTHEASTERN ASIATICS.

A STUDY ON THE ORIGIN OF THE FORMER.

BY REV. A. G. MORICE, O.M.I., M.A.

(*Read 26th October, 1914.*)

It is safe to remark that few questions have so exercised the minds of investigators, given rise to such fantastic systems and resulted in such a bewildering crop of conclusions as that of the origin of the American Indians. The harvest of theories it has occasioned is nothing short of marvellous, and, in many cases, the tenacity of their promoters has been well nigh unparalleled. In fact, so acrimonious have been the discussions it has led to that it has been almost tabooed, as it were, in scientific circles such as, for instance, the International Congress of Americanists.

Hence, though not writing for that learned body, I may as well defend myself at the outset from the intention of adding my own stone to the Babel it has already built up. I shall almost confine myself, in the following pages, to the examination of well-established facts and diligently compare data the genuineness of which is above suspicion. If some conclusions naturally flow from my investigations, they will, I believe, prove all the more irresistible as they will not have been sought.

The fact that, in the face of reiterated invitations, I have waited till the present day to broach this subject and have not dared treat it before I had spent fully thirty-two years in close study will, I hope, go some way towards shielding me against the accusation of temerity, and perhaps convince the reader that, in the present essay, I have no pet theory to uphold and am impelled by the promptings of no hobby.

Moreover, my disquisitions will not bear on the whole American race—if there is such a thing in the world—but shall have for almost exclusive object those Indians in the midst of whom I have lived so long and whose languages, archæology and technology, manners and customs I have studied with a delight which must be felt to be understood, I mean the Dénés of northwestern America.

I.

To return to the Babel which has been unwittingly built up by the students of the fascinating question of the Indians' origin. Incongruous as are the component parts of that edifice, if we study them closely, we may properly reduce them to a certain number of classes. There is, in the first place, the theory of the Jewish origin of our Indians, a theory which has captivated many minds and according to which the natives of this continent are none others than the lost tribes of Israel. Though rather ancient, the tribe of those who embraced that opinion is neither lost nor extinct. It counted ardent and able advocates such as Thomas Thorowgood, Kingsborough, Garcia, Mrs. Simon, James Adair, Israel Worsley, E. Howitt, Dr. Boudinot, Lafitau as regards the Hurons and, in our own days, Father E. Petitot, who seems in this connection of such undoubting faith that he has gone to the length of altering the national name of the stock called Athapaskan by the Smithsonian Institution from Déné, its true designation, into Danite, after one of the Jewish tribes.

This opinion is combatted by James Kennedy, who closes an able paper on the "Question of the supposed Lost Tribes of Israel" by declaring that "the supposition of there being any people now existing as a separate people representing the ten tribes is a groundless hallucination, unworthy of the times in which it has obtained so extensive a credence."

Then there is the Chinese theory, which had earnest defenders in De Guigues, Foster, Du Pratz and the great Humboldt.

The former hypothesis rests mostly on the customs of the American aborigines—especially those of their women; the latter, on their physical appearance as well as on minute fragments of Asiatic history.

A third opinion, which is chiefly based on the same physical analogies, and also on well-authenticated arrivals in America due to the action of the sea currents, would fain see at least in the northwestern Coast tribes relics from the land of Nippon. De Quatrefages, a Mr. Brooks, Viollet-le-Duc and others have perhaps been its ablest exponents.

The Tatars have also been referred to by many as the progenitors of our Indians, in common with the Egyptians and the Tyrians of old. George Jones has been the foremost supporter of the claims of the last named nation in his *History of Ancient America*,[1] but this opinion has been shared by Ledyard and many others. Alexandre Lenoir compares the ancient monuments of the Mexicans with those of Egypt, India, and the rest of the world.

[1] London, 1843.

As to the Tatars, Thomas Morton, who wrote as early as 1637, was just as sure that they could not have been the parents of the aboriginal Americans, though a John Josselyn, whose book was published the following year, unhesitatingly declared that the speech of the Mohawks is "a dialect of the Tartars".[1]

Nor have the Carthaginians been overlooked. They found doughty champions in the persons of a number of monks and ecclesiastics remarkable more for their erudition than for their judgment, no less than in writers of a more popular character.

Most of the authors who have upheld such an origin for the American Indians have found it necessary to use as a prop for their rather fragile theory the famous Atlantis thesis, which predicates the existence in ages long past of a huge island or continent lying between Europe and America. Such superior minds as Sir Daniel Wilson and the celebrated Brasseur de Bourbourg partially or wholly believed in that more or less mythical land.

On the ground of their languages the American aborigines were compared by Barton and Vater with the Mantchous, the Tungus, the Mongols and the Samoyeds, while other elements in their speech would lead the same authors to refer them to the Celts and—save the mark!—the natives of the Congo.[2]

According to Malte-Brun the original inhabitants of Greenland and Chile must belong with the Finnish, Ostiack, Permian and Caucasian families, while some of those of Mexico are allied to the Japanese, the Chinese and the Kourilians; which does not prevent others from being related to the Tungus, the Mantchous, and the Mongols.[3] Another writer of less renown, Siebold, attempted to connect through their vocabularies the Japanese and the Moscas, or Muyscas, a large aboriginal nation in Latin America.[4]

On the other hand, the late Dr. Brinton believed that "the ancestors of the American race could have come from no other quarter than Western Europe, or that portion of Eurafrica which he . . . described as the most probable location of the birth-place of the species".[5]

A. H. Keane formally admits of two routes as having been followed by the immigrants to America, namely some kind of a continent, not

[1] Voyages, p. 124.

[2] *Untersuchung uber Amerikas Bevölkerung aus dem alten Continente.* Leipzig, 1810; Mithrid, p. 340.

[3] *Vide* Wiseman, "Twelve Lectures", pp. 80-81.

[4] *Mémoire relatif à l'Origine des Japonais;* in *Nouveau Journal Asiatique, juin,* 1829, p. 400.

[5] "The American Race", p. 32; Philadelphia, 1901.

the Atlantis of old authors, which he supposes to have formerly united Western Europe to Greenland and Labrador—a supposition which was shared by Brinton—and Behring Straits or the Aleutian islands. This hypothesis, he claims, explains the long-headed tribes of the East and the Mongoloid peoples of the West.[1]

Louis Figuier is not so positive in his *Human Race*. He frankly admits that, in his estimation, "the original race which has peopled the Western Hemisphere is almost impossible to be traced".[2] This is practically the opinion of Father Venegas in his work on early California which is now almost a classic.[3]

Other authors favoured the supposition of a Scandinavian immigration to America, and some investigators have even seen in particular tribes of that continent descendants of the Welsh, the Scotch and the Irish, while others trace them to the Canaanites of old!

The Welsh origin of some American tribes is derived from the declarations of supposedly veracious travellers, like, for instance, a Capt. Isaac Stuart who, in 1782, asserted that he had, in company with a Welshman named John Davey, fallen in with a tribe of Indians of rather white complexion, whose habitat was the valley of a small river which emptied itself into the Red River, and whose language his companion understood without having ever learned it. According to said Capt. Stuart, those Indians claimed that their ancestors had come from a foreign country and landed on what is now called West Florida. They showed, he says, as evidence of their contention rolls of parchment the characters of which Stuart could not read, any more than his Welsh companion who was perfectly illiterate.

Other so-called white races have been reported found "a very considerable distance from New Orleans, whose inhabitants were of different complexions, not so tawny as those of the other Indians and who spoke Welsh".[4] But no such Indians are known to exist in our times, and the presumption is that those above referred to are not any more real than the various nations and personages mentioned in the Book of Mormon, despite the fact that the famous Indian artist Catlin would fain see in the now extinct Mandans a Welsh colony established by Prince Madoc.[5]

[1] "Ethnology", p. 362; Cambridge, 1909.

[2] *Op. cit.*, p. 406; London, 1872.

[3] "History of California", p. 60, first published in Spanish at Madrid in 1758.

[4] S. G. Drake, "The Aboriginal Races of North America", p. 53; New York, 1880.

[5] "Letters and Notes on the Manners, Customs and Condition of the North American Indians", Vol. II, Appendix A; Philadelphia, 1859.

Coming to theories that have attracted fewer votaries, we find that Frederick Wright traces the American Indians back to the Tamils of Ceylon;[1] Charles de Wolf Brownell opines for a Scandinavian descent, at least as regards a portion of our aborigines;[2] Paul Gaffarel stands for a Phœnician origin as far as the civilized nations of Central America are concerned;[3] Lassen saw Buddhists in the aboriginal worshippers of Mexico;[4] Dr. Hyde Clarke believed in a first population of Pygmies, which migrated hither through Behring's Strait and was later superseded by an immigration of "Sumerians", or people of supposedly Accadian parentage.[5]

A French philologist, Julien Vinson, compared the American languages to the Basque idiom of the Pyrenees,[6] whereby he unconsciously walked in the footsteps of an old fur trader, Noël Jérémie;[7] Dr. Latham saw remarkable analogies between the former and those of the Indo-European stock;[8] Prescott was for an Eastern Asiatic, and especially a Mongolian, origin of the primitive Mexican civilization,[9] an opinion which has been extended by many to most of the Northern American tribes.

Swan does not go quite so far to find the parents of the Haidas and other North Pacific coast Indians. He merely compares them to the Kamtschadales,[10] though Dixon and others would go as far as the land of the Maoris to find their ancestors;[11] Bradford claims that "the red race, under various modifications, may be traced physically into Etruria, Egypt, Madagascar, ancient Scythia, Mongolia, China, Hindoostan,

[1] "Origin and Antiquity of Man", pp. 84, 131 and 133; Oberlin, 1912.

[2] "The Indian Races of America"; Boston, 1855.

[3] *Les Phéniciens en Amérique* (*Compte-Rendu du Congrès International des Américanistes*, vol. I, p. 93; Nancy, 1875). A French enthusiast by the name of Le Plongeon, after having studied the stupendous monuments found in that country, was no less certain that they had been erected by the very children of Cain!

[4] *Indische Alterthumskunde*, vol. IV, p. 749 *et seq.*

[5] *Les Origines des Langues, de la Mythologie et de la Civilisation de l'Amérique, dans l'Ancien Monde* (*C.R. Cong. Amér.*, vol. I, p. 157 *et seq.*).

[6] *Le Basque et les Langues américaines* (*Compte-Rendu du Congrès Int. des Américanistes*, Vol. II, p. 46).

[7] *Relation sur la Baie d'Hudson;* Saint-Boniface, 1912.

[8] *Opuscula; passim.*

[9] "History of the Conquest of Mexico", p. 644 *et passim;* London, 1878.

[10] "The Haidah Indians of Queen Charlotte Islands", p. 12 *et passim* (Smithsonian Contributions to Knowledge, 2161).

[11] See "The Coast Indians of Southern Alaska", by A. P. Niblack, p. 385 (Report of National Museum, 1888).

Malaya, Polynesia and America".[1] Further on he states that it "does not appear to be derived from any nation now existing".[2]

A Dr. Williamson, who wrote the history of North Carolina, says none the less that "it can hardly be questioned that the Indians of South America [who incontestably belong to the same race] are descended from a class of the Hindoos, in the Southern parts of Asia".[3]

Francis A. Allen declares that "an unbroken chain of antiquities . . . connects the American and Asiatic continents by way of Polynesia",[4] and my friend, Prof. Charles Hill-Tout is tempted to include the Salish of British Columbia and the northwestern States of the American Union in what he calls an Oceanic classification of peoples.[5]

As to Josiah Priest, he sees "a strong probability that not only Asiatic nations, very soon after the flood, but that also all along the different eras of time different races of men, such as Polynesians, Malays, Australians, Phœnicians, Egyptians, Romans, Israelites, Tartars, Scandinavians, Danes, Norwegians, Welsh and Scotch, have colonized different parts of the continent".[6]

This is scarcely compromising, and such is the number of countries that author believes to have contributed to the peopling of America that he would be most unlucky, indeed, if he did not hit upon some that did really have something to do therewith.

The same author is not so prudent when he attempts to show that "America was peopled before the flood, that it was the country of Noah, and the place where the ark was erected".[7]

A friend of mine, Alphonse Gagnon, studied the origins of only part of that continent, and gave the result of his researches in a readable and well documented book, *L'Amérique Précolombienne.* Therein he is too shrewd to go so far back as the flood, and, after a close inspection of the prehistoric monuments of Central America, he is very much inclined to see in them the work of a Kuschite or Ethiopian people.[8]

I have reserved Cotton Mather's opinion for *la bonne bouche.* Dr. Mather was a zealous Protestant missionary to the Indians of New

[1] "American Antiquities and Researches into the Origin and History of the Red Race", p. 431; New York, 1843.

[2] *Ibid.*, p. 434.

[3] "History of North Carolina", vol. I, p. 216.

[4] *Compte-Rendu du Congrès Internat. des Américanistes*, p. 247; Copenhague, 1884. Dr. Richard King seems of the same opinion ("Narrative of a Journey to the Shores of the Arctic Ocean", Vol. II, p. 33; London, 1836).

[5] J. Roy, Anthropological Institute, p. 134; London, 1911.

[6] "American Antiquities", Preface, p. iv; Albany, 1838.

[7] *Ibid.*

[8] *L'Amérique Précolombienne;* Québec, 1908.

England, fighting as hard against the paganism they owed to the devil as against the forces of the Pope, whom he firmly believed to be His Satanic Majesty's eldest son. The learned doctor wrote concerning his charge: "The natives of the country now possessed by the Newenglanders had been forlorn and wretched heathen ever since their first herding here; and though we know not when or how these Indians first became inhabitants of this mighty continent, yet we may guess that probably the Devil decoyed those miserable salvages hither, in hopes that the gospel of the Lord Jesus Christ would never come here to destroy or disturb his absolute empire over them".[1]

I shall now close my little review, which is far from complete, by mentioning three authors whom I should have quoted in the beginning, had I followed anything like a chronological order. Their conclusions should carry all the more weight as they resulted from an exhaustive treatment of the question. The first is Hugo Grotius, who wrote as early as 1542; then there are Peter Albinus, whose tract was published in 1598, and George Hornius, whose book appeared in 1669. All of them wrote in Latin, but only my copy of Hornius is in the original idiom, both of the others being represented in my library by modern English translations.

Grotius' little work is entitled "On the Origin of the Native Races of America",[2] and is a plea for the Chinese origin of the Peruvians. The author unhesitatingly ascribes to that race Manco Capac, whom he quaintly calls Mancacapus.[3] As to the North American Indians, he sees in them mere Norsemen,[4] while the people south of Panama originated, according to him, in Java or Gilotus,[5] whatever the latter country may be.

Albinus is less discriminating. In his treatise on foreign languages and unknown islands, he practically identifies most of the American nations with the Ethiopians.

As to Hornius, his treatment of the subject is considerably fuller. Instead of a mere dissertation in the shape of a tract, he wrote a book of 503 pages, *De Originibus americanis*, in which he evidently shows himself in favour of the Phœnicians as the ancestors of the American tribes.

Lastly, sick at heart, as it were, of so many conflicting opinions held by their predecessors in the field of science, many of the modern

[1] *Magnalia Christ. Amer.*, book I.

[2] Edinburgh, 1884.

[3] P. 19. Another makes the same personage the son of Kublai Khan, the Mongol emperor (Wiseman, "Twelve Lectures", p. 86).

[4] P. 10.

[5] P. 18.

ethnologists or historians, among whom we must name H. H. Bancroft,[1] would fain do away with the whole difficulty by eliminating all its elements, and pretend that the American Indians are simply autochthonous. But to my mind such a sweeping assertion raises such momentous questions that I prefer to pass it by with the only remark that it could lay claim to greater consideration had not Pasteur's experiments with regard to spontaneous generation ever been made—unless, of course, we should regard the American continent as the cradle of the human race, an hypothesis which is scarcely more tenable than that of the autochthonousness of our Indians.

I, for one, cannot bring myself to entertain such opinions, and must regard the original inhabitants of this continent as emigrants from an older world. Yet it is not my purpose to show in them relatives, or descendants, of any particular race or nation existing under other climes. I merely wish to compare some of the families into which they are divided, especially the Dénés of British North America, with whom I have passed the twenty-four happiest years of my life, with the present inhabitants of northeastern Asia, their neighbours, as it were, and see whether there are between them any points of resemblance which would warrant an ethnological argument.

I am well aware that even such an unpretentious task is fraught with difficulties. The fact that so many wild theories have clamoured for recognition and the very excesses of their promoters cannot but work against all attempts at even mere comparisons. But my purpose is more to state facts than to theorize.

II.

"We may fairly conclude that America was peopled from the northeast part of Asia", writes John McIntosh on page 81 of his book on the "Origin of the North American Indians".[2] He relies on philology to help him prove this assertion. Unfortunately such a resource has been tried by others without much avail. For, as I wrote myself fifteen years ago, "philology is a double-edged weapon, inasmuch as, in the hands of an injudicious enquirer, it may bring forth nothing but futile and imaginary results".[3]

McIntosh gives, indeed, three full pages of words from Algonquin, Sioux and other American languages which would seem to corroborate his opinion. But I repeat that philological comparisons at the hands

[1] "The Native Races", Vol. V, p. 129; San Francisco, 1883.

[2] New York, 1853.

[3] "The Use and Abuse of Philology" (Transactions of the Canadian Institute, Vol. VI, p. 85; Toronto, 1899).

of amateurs are dangerous, and I cannot help remembering, in this connection, the extraordinary feat of the late Professor John Campbell, who imagined that he had successfully identified the Dénés of Northwest America with the Tungus of Asia, on the strength of words which, to a Déné scholar, were as un-Déné as possible.[1]

The first requisite under such circumstances is a clear concept of what is essential in a word. The comparative philologist must mercilessly reject those consonances which are mere accidents in the structure of two languages, and none but the student who has mastered several dialects of a language can be regarded as really qualified to properly distinguish the essential from the accidental.

And then it is so seldom that one meets with a man who is proof against mixing up words, disfiguring them through transcription or ascribing thereto meanings which they never had!

Take but one instance: while disclaiming any intention of seeing in America anything more than adjuncts from Asia to a population which he probably deems to have been autochthonous, the Norwegian Lewis K. Daa adduced in the Transactions of the Philological Society for 1856 some twenty-two pages filled with what he considered to be terms which have identical structures and meanings in both Asia and America. But some of these would-be assimilations are far from reliable.

To speak of only those of which I am qualified to judge, *sikkane* never meant man in any Déné dialect. It is a corruption by unscholarly fur traders of the compound noun *tsé-'kéh-ne*, which means: people on the stones, or Rocky Mountains (*i.e.* Mountaineers).

That same author gives, p. 265, the word *ninastsa* as the would-be Tahkali, or Carrier, synonym for mother, while on the next page he would have this to be *skaka*. Neither term ever meant mother in Carrier. The former is absolutely unknown to that language, while the latter is nothing else than the Babine *skhakha*, which corresponds to our plural: children.

According to the same philologist, *sak* is the Carrier equivalent of the word wife. That term means in that language: alone, apart (Latin *seorsum*), and forms a part of the adjective *sak-œˢta*, which happens to correspond to the opposite of wife, namely single, or virgin. The transcriber of the same had perhaps in mind *s'at*, which means not wife in general, but my wife.

The term he gives for girl *cekwi* is evidently *t'sêkhwi*; but this is synonymous of woman, not of girl, in the same way as his *anna* (or better

[1] "The Dénés of America identified with the Tungus of Asia" (*Ibid.*, Vol. V, p. 167 *et seq.*). See in this connection the latter part of my own essay on "The Use and Abuse of Philology", especially pp. 94-96.

ænna') is the Carrier equivalent not of mother (which is *nellu* in that language), but of the vocative mamma.

The foregoing will suffice to point out the danger of such an instrument as comparative philology in unskilled hands.

Nor would it seem that even trained philologists, widely known for their linguistic acumen, would always be equal to the task of properly comparing languages of which they have themselves no speaking knowledge. This is at least what we are warranted to infer from a paper presented in 1894 to the International Congress of Americanists by the late Dr. Daniel G. Brinton "on the affinities of the Othomi language with Athabaskan dialects". Therein that great anthropologist compared eighty-six words, of which he claimed that "fifty-four present considerable similarity in the two stocks, amounting in various instances to identity, twenty-eight show slight similarity, which might be weakened or strengthened by further investigation, and four present no similarity whatever".

Now I regret to have to state that, after my long years of personal study of five Déné dialects, one of which I came to speak more fluently than my own native French, I cannot with the best of will discover any single analogy between the terms Brinton quotes and those of any Déné idiom, not even between the Déné and Othomi words for father, which he rightly remarks after Alcide d'Orbigny belong "to the universal terms of human language". For the word *ta*, which he gives as the Déné equivalent of father, has that signification in no Déné dialect. It rather means lips, and there is in the eyes of a Déné just as much difference between that word and that for father as there is between it and *me*, which Brinton claims to be synonymous of mother.

What the learned doctor had in view was *-tha* (*œtha*, or *netha*), which contains an aspiration (*t* plus *ha*) which utterly differentiates this monosyllable from the non-aspirated *ta*.

The trouble with Dr. Brinton is that he took as a basis for his comparisons would-be Déné terms derived from a book by a German named J. C. E. Buschmann, which was published as early as 1856. Wherever that author may have taken his material I do not profess to know. Déné words, even when disfigured by the lack of the clicks and aspirations proper to the language, are easily recognizable as such, whether they be published by Drs. Matthews, Goddard, Sapir, or any of the northern missionaries. As to Buschmann's material, it is all Chinese to me. I do not understand a word of it.

Dr. Brinton was all the more unfortunate in his choice as he then had at his disposal my own vocabulary of Déné roots which had appeared

in these *Transactions* four years earlier. Whether this ever came to his notice is more than I can say; but not only did the famous anthropologist know of my humble person (we had exchanged some correspondence), but he refers to me in the very incriminated paper.

Nor should it be forgotten that the essence of a language consists less in its vocabulary than in its grammar and syntax, its peculiar structure and morphology. Its words are its body, but its soul rests in its grammar.

An anthropologist of the French materialistic school, A. Hovelacque, has the following in his work on *La Linguistique:*

"Si l'aptitude spéciale à la connaissance pratique des langues n'est point une science, *l'étymologie*, par contre, telle qu'elle est pratiquée le plus souvent, ne peut être regardée ni comme une science ni comme un art. L'étymologie, par elle-même, n'est qu'une jonglerie, une sorte de jeu d'esprit, si bien que le grand ennemi de l'étymologiste, son ennemi implacable, c'est le linguiste. En un mot, l'étymologie par elle-même et pour elle-même n'est que de la divination; elle fait abstraction de toute expérience, néglige les difficultés et se contente des apparences spécieuses de ce qui n'est qu'à peine probable ou à peine vraisemblable".[1]

By *étymologie* the French author means in the above passage word-assimilations.

Perfectly applicable to amateur or over enthusiastic philologists, his observations, if understood without qualifications, could be considered as exaggerations at the expense of the terminological school. They are prompted by excesses on the part of many of its champions; but they are themselves open to the charge of being an excess the opposite way. *In medio stat virtus*, and there is not the least doubt that terminological comparisons, when properly conducted, can be of much value.

At all events, it is a remark which has by this time acquired the force of an ethnological axiom that of all the anthropological sciences comparative philology is the one whose conclusions have the most weight when it is a question of tracing the origin or parentage of a race.

Witness the case of the Sanscrit roots used by both the blackish peoples of southern Asia and the blonde nations of northern Europe; witness, nearer home, the monosyllabic radicals of the Déné tongue which we now find on the lips of the timid Hare of the northern wastes and the fierce Apache of the South; of the progressive Chippewayan and Carrier of British America and the conservative Navaho of the southern States—and this in spite of the fact that several alien stocks intervene between the two sections of that important aboriginal family.

Prompted by this consideration and moved by the thought that said family could not be autochthonous in America, I published some

[1] *Op. cit.*, p. 16; Paris, sans date (reimpression).

twenty-two years ago a vocabulary of root words representing almost two dozen Déné dialects, with a view to suscitating among philologists investigations which I fondly hoped would result in genuine identifications with Old World counterparts of the same.[1] Although some correspondents qualified for such work kindly endeavoured to make my self-imposed task productive of some fruit, I must to-day confess that the results have proved futile. A few consonant synonyms cannot be regarded as a sufficient basis for ethnic assimilations.

But even though comparative philology does refuse its aid to the solution of the problem of our Indians' origin, some there are, no doubt, who will see in this nothing but a negative proof. If, they will remark, the tribes have left no cognates or agnates in Asia, it does not necessarily follow that they have not originated there, notwithstanding Lord Kaimes' contention to the contrary.[2] A whole tribe, or nation, pressed by powerful enemies or impelled by any other stimulus, crossing into the American continent, would leave no trace behind. It would, on the contrary, have carried in its own bosom, over the slight obstacle formed by Behring's Strait or the stretch of water dotted by the chain of the Aleutian Islands, unmistakable tokens of its former sojourn in Asia in the shape of similar customs, an identical technology, or even an analogous mythology.[3]

This being so, I now propose to examine, in the first place, whether there is any possibility of at least the Dénés of America having migrated from the adjoining continent. In the case of an affirmative finding, we

[1] "Déné Roots" (Trans. Can. Inst., Vol. III, p. 145 *et seq.*).

[2] "Sketches of the History of Man", Vol. II, p. 71; Edinburg, 1774.

[3] From the tribal name of the Yakuts Dr. Latham infers previous commerce of some sort between the Americans and Aleuts, on the one part, and the Asiatic people that bears it, on the other. "The name *Yakut*", he writes, "unless we have recourse to the convenient doctrine of accident, cannot well have been taken by those who first applied it to the Sokhalar, from any language except either the Eskimo or some form of speech akin thereto. There was, at some time or other, someone on those parts about the Lena, who called someone *Yakut*. Now, the American Eskimo on the Lower Kwikpak, have, as their name for *men* or *people*, the word *tshagut*. In the Aleutian Archipelago this becomes *tagut* or *yagut*. I believe this to be the root of the name *yakut-at* in Prince William's Sound. So that *yagut* (*yakut*) is an Eskimo word; and at the same time a name in use as far from both America and the Aleutian Islands as the River Lena. How came it there? The name was *not* native. Nor yet Koriak. Nor yet Yukahiri—*that we know of*. In the present state of our knowledge, it is only the Eskimo tongues that supply this gloss. As far, then, as it goes, it is evidence in favour of a tongue allied to the Eskimo having been once spoken as far westwards in Asia as the Lena. For the encroachment which must have displaced it, we have considerable evidence. The Yakut themselves are evidently recent; the Koriak traditions bring them from the south. The Yukahiri language is remarkable for its isolation, and isolation implies displacement" ("The Native Races of the Russian Empire", pp. 183-84; London, 1854).

will proceed to see whether this mere possibility cannot be converted into a probability, or even some kind of moral certainty.

III.

In the light of present geographical conditions, it seems almost idle to try to prove the possibility of migrations from Asia to America. Without going as far back as the time when geologists contend that both continents were united, we see that they are to-day separated only by the very slightest obstacle to intercourse, namely a sheet of water barely thirty-five miles in width, which sometimes freezes over, so that even white men are known to have crossed it on foot.

We are furthermore aware that this narrow strait is dotted with islands, which would become as many stepping-stones to him who would recoil from the task of covering such a short distance in a single effort.

Nay, not only is the crossing of this strait possible, even for small craft,[1] but we know that it is commonly effected by both Asiatics and native Americans. "The Tchuktchis . . . cross from the coast of Siberia by the narrow part of Bering Straits and generally meet the Kareaks and Malemutes in Port Clarence", writes the traveller Fr. Whymper, who adds that "intertribal commerce goes on to such an extent that clothing, worn hundreds of miles up the Yukon . . , is of Tchuktchi origin".[2]

According to J. Bush "beaver are procured from the Tchuctchus, who in turn get them from the natives on the east side of Behring's Strait".[3]

Though emanating from an explorer who, like Whymper, was on the spot, this statement is but an unconscious echo of that of Wrangell, according to whom "le passage est si aisé de cette partie du rivage asiatique sur le continent américain que les Tchouktchis franchissent chaque année le détroit pour aller chercher en Amérique les pelleteries qu'ils viennent vendre dans les villages de Sibérie".[4]

These are the words of a navigator who observed these conditions close on one hundred years ago.

An eye-witness of a later day, Frederick Schwatka, likewise testifies to commercial intercourse between the Asiatic and American tribes.[5] So does an earlier author, P. Dobell.[6]

[1] Sir George Simpson, "An Overland Journey round the World", Vol. II, pp. 201-202; London, 1847.

[2] "Travel and Adventure in the Territory of Alaska", p. 138; London, 1868.

[3] "Reindeer, Dogs and Snow-Shoes", p. 308; New York, 1871.

[4] Voyages, vol. I, p. 249.

[5] "Along Alaska's Great River", p. 323; Saint Louis, 1893.

[6] "Travels in Kamtchatka and Siberia", Vol. I, p. 144; London, 1830.

A still older one, who wrote at a time when the distance between the two continents had not yet been ascertained, exclaimed in the course of his "Voyages from Asia to America" "This is certain, that the Tschuktschi get Cloaths of Martins Skins from hence [*i e* from America]; some such have now and then been brought from Anadirskoi [an island in the Gulf of Anadyr] to Jakutzk, as is known to every Person thereabouts" [1]

Lastly, Sir George Simpson, the celebrated Hudson's Bay Company magnate of the first half of the nineteenth century, tells us that the object of a certain expedition he speaks of "was to occupy the country by posts in order to protect the trade from the Tchuktchi of Siberia, who cross the straits every summer to traffic with the American Indians, carrying their furs, ivory, etc , to the fair of Ostrovnoye".[2]

Just think of it! The commercial relations between the natives of Asia and America so frequent that they disturb the equanimity of such powerful traders as the Hudson's Bay Company people!

And no wonder For it stands to reason that, especially among primitive and more or less nomadic races, a sheet of water the opposite shores of which can be seen with the naked eye by any one standing on either of them can be no serious impediment to intercourse.[3] And if such a passage is commonly effected for the sake of gratifying one's cupidity or whims, it is at least as possible in cases of personal or national necessity.

And yet we hear a writer of the weight of Dr H Rink, the foremost Protestant missionary to the Eastern Eskimos, declare in no uncertain accents that "il est *tout-à-fait impossible* que des peuplades disposant exclusivement de pirogues du genre de celles dont font usage les habitants de l'Australie et des îles de la Polynésie aient pu faire le trajet d'Asie en Amérique, à une latitude aussi boréale que l'est celle des régions où les côtes du Nouveau Monde et de l'Ancien sont le plus rapprochées".[4]

The italics are his, and render his declaration all the more difficult to reconcile with a common sense view of the question. Why, the natives of Australia and Polynesia are provided with canoes of such an enormous size that they undertake therewith long and perilous voyages on the high seas! On the other hand, we read of an incestuous Aleutian who, in the company of his daughter, after "pushing off in a baidarka from

[1] S Muller, "Voyages from Asia to America, p. XXIX.

[2] *Op. cit.*, Vol. II, p 201

[3] Hooper, "The Tents of the Tuski", p 168, London, 1853.

[4] *Compte-rendu Cong. internat Américanistes*, Vol. II, p. 328; Luxembourg, 1878.

ICE IN KOTZEBUE OR BEHRING STRAITS

Kodiak, paddled steadily to the southward for *four* days till [the couple] came to an island which was previously unknown".[1]

Yet, in size and sea-faring qualities a baidarka is scarcely anything compared with the immense canoes of the South Sea islanders.

And then there is the highway offered by the chain of the Aleutian Islands, which seem to have been thrown out by the hand of the Creator for the express purpose of still facilitating such inter-continental migrations. Their own inhabitants show by their fearlessness on the high seas what others could do under the impulse of necessity. "It is not uncommon for the Aleutians to make long voyages in their small baidarkas, often going fifty or sixty miles from land to hunt the sea-otter", writes Sir George Simpson.[2]

On the other hand, speaking of the inhabitants of the Fox Islands, Hooper remarks that "they seemed to migrate from island to island, and many to the mainland of America".[3]

Finally, an author who wrote one hundred and fifty years ago, or rather published at that time the translation of a work written long before, thus records the presence in Asia of a native of America:

"It is said that in the Year 1715, there lived a Man of a foreign Nation at Kamtschatka, who, upon Account of the Kamtschatkan cedar Nuts, and the low Shrubs on which they grow, said, that he came from a Country where there were larger Cedars, which bore bigger Cedar Nuts than those of Kamtschatka; that his Country was situated to the East of Kamtschatka; that there were found in it great Rivers, which discharged themselves westward into the Kamtschatkan Sea; that the inhabitants called themselves Tontoli; they resembled, in their Manner of Living, the People of Kamtschatka, and made use of Leathern Boats, or Baidares, like the Kamtschadales: That, many Years ago, he went over, with some more of his Countrymen, to Karaginskoi Ostrow, where his companions were slain by the Inhabitants, and he alone made his Escape into Kamtschatka".[4]

Moreover, we gather from the same old author that the passage from one continent to the other is considerably facilitated by nature. He further writes:

"On Karaginsko Ostrow, an Island opposite the River Karaga, by which it is called, it is said, in the subterraneous Dwellings of the Inhabitants, there are observed great Beams of Pine and Fir Frees, with which these Caves are partly wainscotted: The Inhabitants being asked whence they had these Beams, since such Kind of Wood was not

[1] Geo. Simpson, *op. cit.*, Vol. II, p. 220.
[2] *Op. cit.*, Vol. II, p. 220.
[3] "The Tents of the Tuski", pp. 9-10.
[4] S. Muller, *op. cit.*, p. XXVIII.

found in Kamtschatka, or the neighbouring Islands? They made answer that, someti es, they were driven on Shore by easterly Winds, when, for Want of Wood in the Island, they used to take them and make Use of them".

The same element that carries wood one way over the sea can certainly help carry people another way, when a different season contributes to give it another direction.

The question of the possibility of a migration from Asia to America is therefore fully solved. We know it to be not only possible but easy, and we are further certain that it has been accomplished by individuals.

But is such migration probable in the case of large bodies leaving their ancestral homes for the unknown regions of a new world? Why could not the natives of America have originated in the country they now inhabit?

The consideration of a few undeniable facts in connection with the original state of this hemisphere will help us in the solution of these problems. Some of them will even aid us in determining the quarters from which our Indians must have migrated.

IV.

It is generally conceded that there never was a continent so sparsely peopled as was aboriginal America. Was this because of the barrenness of the soil or the severity of the climate? The white races there established at the present day have given an emphatically negative answer to the first part of this question, and, as to the second, the particular lay of the land ensures therefor as much temperate, or warm, as cold climates.

In the name of what principle, then, shall we surmise that, after having been the cradle of the human race, America should have been left almost deserted by its original population who, in that supposition, must have rushed to the dreary wastes of northern Asia and the mountainous regions of its centre, the cold forests and marshes of Europe, or the sun-burnt sands of Africa? Such hypotheses cannot be taken seriously.

A second incontestable fact is that, despite the sparseness of the aboriginal population of the New World, there is not an equivalent part of the earth where so many ethnologically distinct races can be found within any given area. "Choose any tract of the old world where you think most languages spoken, then select an equal space at random in any district of America peopled by native tribes, and the latter will assuredly give a greater number of various tongues".

This is from the writings of an erudite author who was merely echoing one of Humboldt's declarations.[1]

North of Mexico alone, we have no less than fifty-eight families, whose languages have not anything more in common than vague and exceedingly broad characteristics, which cannot be adduced as valid criteria of ethnic assimilation.[2] Not one word of a particular stock will ever be found repeated in another, unless it be a loan word due to commercial intercourse; the grammar and morphology of each are irreconcilably different, with scarcely any trait of resemblance.

Does not that wonderful diversity point to extraneous origins, to some accidental importation from unrelated quarters?

The answer is ready at hand, and we implicitly find it in a third ethnological fact which is no less established: "A marked feature of the distribution of Indian linguistic families north of Mexico is the presence, or former existence, in what are now the States of California and Oregon, of more than one-third of the total number, while some other stocks . . . have a very wide distribution. The Pacific coast contrasts with the Atlantic by reason of the multiplicity of its linguistic families as compared with the few on the eastern littoral".

These remarks are not mine. I take them from the sketch of the American linguistic families in the "Hand-book of American Indians" by our common lamented friend, the late Dr. Alexander Chamberlain.[3]

That anthropologist had chiefly in mind the aboriginal population of what is now the United States. If we turn to Canada, the appositeness of his last remark will be greatly enhanced. As everyone knows, fully five-sixths of the territory of that country lies east of the Rocky Mountains. Yet, within that immense stretch of land, we find only three aboriginal stocks, namely the Iroquois, the Algonquin and the Déné. I do not mention the Sioux, who are a recent intrusion, or the Eskimos, who can hardly be considered an American race, since they are found in Asia and the inter-continental islands. Moreover, they belong as much to the west as to the east slope of the Rockies.

Now there are no less than six unrelated families within the remaining sixth part of Canada's territory, that is, on the Pacific coast and the land intervening between it and the Rocky Mountains. These are the Kootenays, the Salish, the Kwakwiutl, the Haidas, the Tsimpsians

[1] Cardinal Wiseman, "Twelve Lectures on the Connexion between Science and revealed Religion", pp. 78-79; London, 1842.

[2] I am well aware of the fact that an effort is now being made to find analogies between some of these stocks with a view to reducing their number (See "American Anthropologist", Vol. XV, p. 647 *et seq.*). But these pretended verbal assimilations will seem far-fetched and little convincing to more than one American philologist.

[3] Vol. I, p. 767.

and the Dénés, to whom I should add the Tlingets, whose habitat is the narrow strip of land known as Southern Alaska, which geographically belongs to Canada.

Seven stocks west of the Rockies to three east thereof, in a region which, if the normal proportions were observed, should contain no less than forty-five of them!

Why this extraordinary disparity? Has it never struck any ethnologist as being significant? In my humble opinion, only one answer can satisfy the unbiassed enquirer: most of the Canadian Indians are but pieces of wreckage brought from the neighbouring continent, descendants of stray representatives of the native Asiatics thrown by accidents on the Pacific coast, which became the dumping ground of western adventurers—by this I mean the maritime tribes of British Columbia—or brought to their present homes through the northwest corner of the continent or the Aleutian Islands by means of voluntary or forced migrations: in these we have the Dénés of the Northwest.

In the same way, therefore, as the general sparseness of the American native population excludes the possibility of autochthonousness, unless we choose to believe in principles the falsity of which has been demonstrated, even so the significant fact that most of the races into which this population is divided have their habitat on the Pacific slope points to the Asiatic continent as the supply house of the same.

V.

Let us now restrict the field of our enquiry and question the Dénés of Canada on their origin. They generally seem to know little on this point; but whenever they will vouchsafe any answer at all, it will be to the effect that those east of the Rocky Mountains originally came from the west or the northwest, while those of British Columbia unconsciously stand for a migration from the north.

Practically all have a more or less confused tradition of having crossed, in the dim past, a body of water strewn with islands. The very fact that they believe their country to be an island would seem to confirm this. According to Sir John Franklin, the Dog-Ribs do so call the earth,[1] and this fact is fully corroborated by Petitot.[2]

Sir Alexander Mackenzie tells us that the Chippewayans "have a tradition among them that they originally came from another country,

[1] "Narrative of a Journey to the Shores of the Polar Sea", Vol. II, p. 295; London 1823.

[2] *Essai sur l'Origine des Déné-Dindjié* (prefixed to his polyglot dictionary), p. XXVII; Paris, 1875.

LOUCHEUX CAMP, YUKON

inhabited by very wicked people, and had traversed a great lake, which was narrow, shallow and full of islands, where they had suffered great misery, it being always winter, with ice and deep snow".[1]

If we are to believe Franklin, the Rocky Mountain Indians are even more explicit on this head. They claim that "they came originally from the westward, from a level country, where there was no winter, which produced trees and large fruits now unknown to them. It was inhabited by many strange animals, amongst which there was a small one whose visage bore a striking resemblance to the human countenance.[2] During their residence in this land, their ancestors were visited by a man who healed the sick, raised the dead, and performed many other miracles, enjoining them at the same time to lead good lives, and not eat of the entrails of animals, nor use the brains for dressing skins until after the third day; and never to leave the skull of deer upon the ground within the reach of dogs and wolves, but to hang them carefully upon trees. No one knew from whence this good man came, or whither he went.

"They were driven from that land by the rising of the waters, and, following the tracks of animals on the sea-shore, they directed their course to the northward. At length they came to *a strait*, which they crossed upon a raft, but the sea has since frozen, and they have never been able to return".[3]

So much for the Chippewayans and the Rocky Mountain Indians. The northernmost Déné tribes are the Hares and the Loucheux. In the early sixties Father Petitot, who could speak their languages, recorded the following from the mouths of the former:

"Ils habitaient jadis bien loin dans l'occident, au-delà de la mer et au milieu d'une nation fort puissante, chez laquelle les magiciens avaient le pouvoir de se transformer en chiens ou en loups durant la nuit, tandis qu'ils redevenaient hommes pendant le jour. Ces ennemis avaient pris des femmes parmi les Dénés, mais ces créatures ne participaient en rien aux pratiques occultes de leurs maris.

"Ces ennemis, les Peaux-de-Lièvre les nomment *Kfwi-dételé* (têtes pelées); car ils se rasaient la tête et portaient perruque".[4]

The Loucheux have their habitat both in the Lower Mackenzie basin and in the Yukon and Alaska. They are, therefore, those who

[1] "Voyages from Montreal through the Continent of North America", p. CLXIII of his preface (Toronto reprint).

[2] Evidently some kind of *Siniidæ*, none of which is to be found in America. Father Petitot also records a similar tradition.

[3] *Op. cit.*, vol. I, p. 293.

[4] *Essai sur l'Origine des Déné-Dindjié*, p. XXVIII.

must have been the last to cross into the American continent and have kept most vivid the remembrance of such a passage. Here is what Petitot writes by way of describing the dog-like enemies of the Dénés of old:

"Les Loucheux nous les dépeignent comme très vaillants mais immoraux et allant presque nus. A la guerre ils portaient des casques de bois, des boucliers en peau très dure suspendus â l'épaule et un vêtement recouvert d'écailles (cuirasses). Leurs armes, disaient-ils, étaient des couteaux tranchants liés au bout d'une perche (lances)".[1]

This description of the Dénés' former enemies, in whom Petitot would fain see a very distant nation, fits admirably the natives of northeastern Asia, the inhabitants of the Fox and Aleutian Islands, and even the Kollush or Tlingets of the Alaskan littoral.

To the simple-minded and much more reserved Dénés, all those tribes are the very essence of immorality and lasciviousness. I have myself time and again heard the Carriers characterize them as dogs, and such travellers as saw them before they had adopted some of our ways are at one in chronicling the entire lack of restraint of those people.

Speaking of the Fox Islanders Coxe remarks that "they do not observe any rules of decency, but follow all the calls of nature publicly and without the least reserve. They wash themselves in their own urine".[2]

This last particular is also recorded of the Tchuktchis of Asia.[3]

As to the shaving of the head, G. Sarytchew says that the Aleutians "cut the hair of the forepart of the head".[4] Of another tribe, whose habitat is likewise between the two continents, the same traveller has it that "they cut off all their hair, except one tuft on the crown".[5] Coxe himself writes of the aborigines of Unalaska that "the men shave with a sharp stone or knife the circumference and top of the head",[6] while Shelekoff says of the "Konæges" that among them "both men and women cut [the hair] about the head".[7]

With regard to the Dénés' traditional enemies going "almost naked", this is just as true of most of the Aleutians, Eskimos, Tlingets and

[1] *Ibid.*

[2] "Account of the Russian Discoveries between Asia and America", p. 175; London 1787.

[3] S. Muller, "Voyages from Asia to America", p. XXVII.

[4] "Account of a Voyage of Discovery to the North-East of Siberia", Vol. II, p. 9. London, 1806.

[5] *Ibid., ibid.*, p. 18.

[6] *Op. cit.*, p. 176. See also p. 197.

[7] "The Voyage of Gregory Shelekoff, a Russian, from Okhotsk, on the Eastern Ocean, to the Coast of America", p. 36.

eastern Siberians. The blanket thrown over the shoulders of the Tlingets can scarcely be said to cover their nakedness, any more than the bird skin costume of the Aleutians, inasmuch as men of either tribe discard every vestige of clothing on the slightest pretext.

As to the Eskimos of the Far West, it is well known that they sleep stark naked. Of the aborigines he calls "Konæges" the Russian Gregory Shelekoff writes also that they "wear no shirt, go barefoot and when at home are quite naked",[1] while an old author asserts that, among the Koriaks of Siberia, "a whole Family will lie all naked together under one large Coverlet".[2] The same writer then goes on to describe others of their habits which had better be explained in Latin than in modern English.

Apropos of vestments made of birds' skins, they are, I believe, characteristic of all the aboriginal Aleutians. In fact, Coxe mentions them no less than ten times in connection with as many native groups of their archipelago and that of the Fox Islanders. Of the latter he writes: "The men wear shirts made of the skins of cormorants, sea-divers and gulls",[3] and of others he says: "The natives of the above mentioned islands are very tall and strongly made. They make their cloaths of the skins of birds".[4]

With regard to his "Konæges" Shelekoff mentions clothing of similar material,[5] while the same was used quite close to the Asiatic continent and far from America, namely on an island lying opposite Anadyrskoi Noss (or Cape Anadyr), according to Wrangell, who writes: "This race have a language of their own and make clothes of duck-skins".[6]

Now the Tsœtsaut, a North Pacific coast subtribe of the Dénés, and, I believe, the Carriers, whose habitat is Central British Columbia, claim that they formerly wore an identical sort of clothing.[7]

According to Petitot, the Loucheux's, original enemies with whom they parted in course of time to reach their present quarters, wore wooden helmets. But Coxe tells us that, in the spring of 1754, the Russians discovered an island which "seemed to be opposite to Katyskoi Noss, in the peninsula of Kamtchatka," whose inhabitants wore "wooden

[1] *Ibid., ibid.*

[2] S. Muller, *ubi suprà*, p. IX.

[3] "Account of the Russian Discoveries", p. 197.

[4] *Ibid.*, p. 75. See also Sarytschew, "Account of a Voyage of Discovery", pp. 8, 18; also S. Muller, "Voyages from Asia to America", pp. XXII, XXIV.

[5] *Op. cit.*, p. 37.

[6] "Narrative of an Expedition to the Polar Sea", p. 414; London, 1844.

[7] Tenth Report on the North-Western Tribes of Canada, p. 560.

caps, ornamented with a small piece of board projecting forwards, as it seemed, for a defence against the arrows" [1]

Of the inhabitants of Alaxa, Umnak, Unalashka and the neighbouring islands, the same author likewise records that "on their heads they wear wooden caps, ornamented with ducks feathers and the ears of the sea-animal called *Scivutcha*, or sea-lion".[2]

With regard to the other defensive weapons attributed to the Dénés' traditional enemies, they are also to be found, without an iota of difference, among the same maritime aborigines I myself minutely described, years ago, both of the kinds of armour mentioned by Petitot's informants [3] I gave them out as the Carrier shield and cuirass, but they are common to all the North Pacific coast Indians By referring to Coxe's valuable work, we find the same among the islanders of the Far West—and probably the Asiatics of the Extreme East as well

"On the 4th of October [1763] about two hundred islanders made their appearance, carrying wooden shields before them, and preparing with bows and arrows for an attack", he writes of the natives met by the Russians on Kadyak Island [4] A specimen of this armour having fallen into the hands of the white explorers, it was found to be "made of three rows of stakes placed perpendicularly, and bound together with sea-weed and osiers; they were twelve feet broad, and about half a yard thick" [5]

As to the "couteaux tranchants liés au bout d'une perche", these were also to be seen throughout the same region, viz the North Pacific coast of America and west thereof, as well as the wigs which the Dénés' old enemies are said to have worn.

All of which cannot but create the impression that the Dénés traversed that country while on their way to their present habitat

VI

So much for the traditions of the Eastern Dénés.

The main division of those who live west of the Rockies is the Carrier tribe, the seats of which are around the numerous lakes of Central British Columbia. The Carriers have no reminiscence of having moved from a western continent. They even contend that they always dwelt

[1] *Op cit*, p. 56.

[2] *Ibid*, p. 211 See also Sarytschew, *ubi supra*, Vol II, p 59

[3] "Notes . on the Western Dénés" (Transactions of the Canadian Institute, Vol. IV, pp. 117 and 149, Toronto, 1893)

[4] *Op. cit*, p. 129.

[5] *Ibid.*, p. 130.

ALEUTS IN ANCIENT COSTUME

in the country which they now inhabit. But, in addition to the fact that such a contention is not altogether disinterested on their lips,[1] we find in an apparently unimportant declaration of theirs an implicit admission that their present habitat is certainly not that of their ancestors.

Their old men assert that "formerly days were exceedingly short; so short indeed that all a woman could do between sunrise and sunset was to hem a muskrat skin". This undoubtedly refers to the Arctic or Subarctic regions as a previous home, or place of passage, for the tribe.

Another proof that those Indians came from the north I find in a word of the dialect of the Tsilkotins, their immediate neighbours and the southernmost Dénés in Canada.[2] They call the particular kind of grass (*Poa tenuifolia*) known as bunch-grass, which is one of the most valued possessions of their present country, *Œnna-t'lâ*, which means "grass of the Foreigners", that is the Shushwaps.

This shows, in the first place, that they now inhabit a stretch of land formerly belonging to the latter tribe, and, secondly, that they reached it by means of a southward migration. The Shushwaps live immediately to the south of the Tsilkotins, and it is inconceivable that the latter should have forced their way through the preserves of the former to get at their present quarters, especially when we consider that, to the north of these, there are none but congenerous tribes as far as the territory of the Eskimos.

Moreover, it is within the recollection of even living men that the bulk of that tribe moved, some fifty or sixty years ago, from the northwestern forest, where bunch-grass is unknown, into the valley which is to-day the home of most of them and the most noticeable particularity of which is the luxuriant bunch-grass pastures on which feed their numerous bands of horses.

[1] As may be gathered from the following case, which occurred among their immediate neighbours in the north. "About 1820, an accident happened whereby the entire portion of the Babine tribe living along the Bulkley was deprived of its fishing grounds (See my "History of the Northern Interior of British Columbia", p. 8). These Indians then took forcible possession of the fishery near the mouth of the river, which had previously belonged to a Tsimpsian tribe, and have kept it ever since. Some difficulty having lately arisen between the two races, the question of the right to the fishery was brought to the attention of the Agent, when the Babines unblushingly and very loudly protested that the disputed grounds had always been theirs. In the course of a generation or two, what is now known to be false will probably be regarded as the merest expression of truth.

[2] With the exception of a band of the same tribe who, impelled by that instinctive impulse which leads them southward, established themselves not very long ago in the valley of the Nicola, within the same province of British Columbia.

But we have a still clearer, if not stronger, evidence of the Dénés having migrated from the northwest, that is from Asia. In the basin of Greater Bear Lake lies a large steppe, the southern end of which is known to the present day Indians under a native name which means "The Last Steppe", while there is in the same region a mountain called "The Last Mountain" by the natives of the same country. This being the southernmost of a group of mountains, it should have been named "The First Mountain" if the Indians responsible for its designation had followed a northerly direction in the course of their prehistoric migrations.[1]

Then, as if to preclude the possibility of an error in this respect, the northernmost mountain of the same group is called by a Déné word which means "The First Promontory".[2]

It is therefore evident that when those aborigines saw for the first time that country, they were travelling from north to south. On the other hand, as those who still live in a higher latitude claim that they came from the west, and as almost all the Dénés have a tradition of a passage by water, I fail to see how we can escape the conclusion that they reached America through Behring Strait or the Aleutian Islands, and that such of them as crossed the Rockies took a southeastern direction, while the others made directly for the south.

The strength of these conclusions becomes still greater by a consideration of the unmistakable fact that the migrations of all the Dénés in America have invariably been southward. Several of the northern tribes, such as the Sarcees, the Beavers and the Tsilkotins, had but lately a more northern habitat. Instinctively, when not meeting with resistance at the hands of a body of people already in possession of the country, they have tended towards the more hospitable climes of the south.

The best proof I can adduce of this, in addition to the three above mentioned instances, is that which we find in the presence in Arizona and New Mexico of the Navahoes and the Apaches, the two foremost Déné tribes as far as population is concerned, as well as in the different bodies of stragglers in the southward march whom we now call the Kwalhioquas of the State of Washington, the Umpquas of Oregon, and the Hupas and others of California.

That the Navahoes come from the north there is not the shadow of a doubt. True, the late Dr. D. G. Brinton wrote somewhere that they "have no reminiscence of their ancestral home in the north".[3]

[1] *Exploration de la Région du Grand Lac des Ours*, pp. 124 and 313; Paris, 1893.

[2] *Ibid., ibid.*

[3] "The American Race", p. 72; Philadelphia, 1901.

But even though this statement were correct, we must not forget that it is a well known practice of the native mind to transfer to places within its actual knowledge and vicinity the scenes of the happenings handed down by the ancestors.

But a correspondent of mine, Father Leopold Ostermann, O.F.M., who has long and faithfully laboured among the Navahoes and whose pen has yielded valuable information concerning that important tribe,[1] wrote but a few years ago:

"The Navajos have a faint tradition of other Navajos, or Diné, away to the North, whom they call 'Déné nahodloni', *i.e.* 'they who are also Navajos' . . . They even tell of a party of Navajos who once set out to look up the Déné Nahodloni, and say that their hunters found their fellow-tribesmen, stayed with them a short time, and then returned to their homes in the south, after their northern kin had refused to go with them".[2]

In a private letter to me Father Leopold confirmed his printed statement by adding:

"Most of the old Navajos, at least all the old-timers whom I have asked, know something about the Déné Nahodloni . . . They know that somewhere, at a great distance, there are 'people who are also Déné', who speak their language, and who at one time were one people with themselves. They do not mean the Apaches, for the Apaches have time and again made themselves very clearly and distinctly known to the Navajos. The home of the Déné Nahodloni is said by some to be in the north, by others in the northwest; most of them do not know in which direction to place it".[3]

These declarations by one who has first-hand knowledge of what he writes about must for ever set at rest the question of the origin of the Navajos, and convince the reader that the southernmost of all the Déné tribes really came from the north or the northwest.

VII.

Physiology, sociology and technology are at one in confirming us in the belief that the whole of the so important aboriginal family which we call, or rather which calls itself, Déné is a relatively late arrival on the continent of America. I shall not dwell on the similarity of the

[1] As far as numbers go the Navahoes form what I believe to be the most important tribe of all North America outside of Mexico. They are to-day estimated at no less than 28,500 souls.

[2] The Catholic Pioneer, Oct. 1905.

[3] December 27, 1905.

Indian type with that of the inhabitants of northeastern Asia. All travellers and ethnologists, Wrangell, Peter Dobell, J. Bush, Latham, Geo. Simpson and others have noticed it.

This physical resemblance is so striking that, when on the 5th of September, 1741, a certain Lieutenant Waxel, a pioneer among the pioneer explorers of America from Asia, had tried in vain to hold intercourse with the first native Americans he saw, he ordered three of his men to land and make for the strangers. Among the three men was a Koriack who acted as his interpreter. Then the chronicler of his voyage (who wrote just one hundred and fifty years ago) remarks that "it has been observed everywhere that the Tschuktschian and Korjak interpreters did not understand the language of these people; but they were nevertheless very serviceable as conductors, being bold and *looked upon by the Americans as the same with themselves*".[1]

The personal ornaments, the labret, nose and ear pendants, of the North Americans were also prevalent among several Asiatic tribes.

Both divisions of the human family are remarkable for the quasi-absence of facial hairs, and I have described[2] the way the Dénés used to pluck out the few that nature would grow on their upper lip and chin. Now, an old author writes of the Koriacks of Siberia: "They are beardless, like the Laplanders, Samojeds and Ostiaks; for, in the first Place, they have naturally very little Hair about the Mouth, and what little they have they pluck out as do also the Jakuhti, Tungusii and Kalmucks".[3]

The habitations of the semi-sedentary Dénés, such as the Carriers and their neighbours in the west, have likewise their exact counterpart in Siberia. "The Jakutian habitations are of two kinds", writes Wrangell. "In summer they are Urosses, which are light circular tents formed of poles and covered with birch-bark, which they strip from the trees in large pieces . . . At the approach of winter, they occupy their warm Yourtes [compare with the Carrier synonym *Yœrh*]. These are cottages formed of thin boards".[4]

[1] S. Muller, "Voyages from Asia to America", p. XLVI.

[2] "Notes on the Western Dénés", p 138.

[3] S. Muller, *op. cit.*, p. VIII

[4] "Narrative of an Expedition to the Polar Sea", p. 24 The houses of the Tuskis (Tchuktchis) are called *yarang* according to Hooper A little particularity in connection with those aborigines is, I believe, all the more worthy of mention as I have otherwise been unable to find the least resemblance between their language and that of my Dénés. Hooper writes: "We were much attracted and amused by their expressions of astonishment at any new wonder. Kah—kah—kah—was the universal ejaculation of surprise" ("The Tents of the Tuski", p. 21). Now this is precisely the interjection to which the Carriers resort when they want to express surprise. "'*Kah 'kah 'kah* they exclaim, meaning. Now, is not that wonderful!"

INTERIOR OF A YOURTE OF SETTLED KORIACKS

George Kennan makes the same distinction with regard to the homes of the Kamtchadales[1] and G. Sarytschew in connection with those of the Tchuktchis.[2] In fact, all the authors on northeastern Asia make the same distinction.

Now this applies equally well to the Western Dénés, Carriers and Tsilkotins, whose summer and winter houses I have described in my "Notes . . . on the Western Dénés",[3] and the navigator Marchand noticed himself this similarity between the technology of peoples of the Old and the New Worlds when he wrote that "the distinction between the winter and summer habitations of the Queen Charlotte Islanders recalls to mind the custom of the Kamtschadales who have their *balagans* for summer and their *jourts* for winter".[4]

Even farther west in the same immensity of Siberia, a late traveller saw, in the valley of Lake Baikal, "clusters of tents exactly like Red Indian tents. They belonged to the aborigines, Buriat Mongols, who are vanishing before the Muscovites as the Redskins are vanishing before the Saxons".[5]

Speaking of the Carrier villages I wrote, twenty-two years ago, that they were generally situated "on the north banks of lakes, so as to have the benefit of the sun's rays from the opposite side",[6] and that the houses that formed them had no other chimney than an aperture in the roof. But Wrangell tells us that those of the sedentary Tchuktchis are built in such a way that "the low entrance is always turned to the south", and that "at the top there is a hole for the smoke to escape".[7]

I have described in the above mentioned work the native American ladder, "that is, a log notched at the proper stepping intervals". This is apparently a very small, yet significant, detail, since it requires the higher culture of the Pueblo Indians to think, in connection with that household necessity, of two sticks with cross-pieces. We find a counterpart of the former among the Gilaks of Siberia, as R. J. Bush tells us when he states that the platforms round their houses "are reached by rude steps cut in a log".[8]

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[1] "Tent Life in Siberia", p. 153, New York, 1910.
[2] "Account of a Voyage of Discovery", Vol. II, p. 49.
[3] Trans. Can. Institute, Vol. IV, pp. 185-89.
[4] Quoted by Swan, "The Haidah Indians of Queen Charlotte Islands", p. 12.
[5] John Foster Fraser, "The Real Siberia", p. 137; London, 1904.
[6] "Notes", p. 184.
[7] *Op. cit.*, pp. 358-59.
[8] "Reindeer, Dogs and Snow-Shoes", p. 103.

Peter Dobell mentions also seeing among the Kamtchadales "a piece of timber placed against the edge of the hole, with notches cut in it to receive the feet—a miserable substitute for a ladder".[1]

In the close vicinity of the Carriers' and other Dénés' homes is to be seen the aerial provision store, of which a figure and description will be found p. 196 of my above referred to "Notes". An equivalent of this prevails in Siberia, according to the explorer Bush, who writes: "Belonging to each house and erected on a scaffolding near by, several feet above the snow, out of the reach of dogs, were conical and pyramidical structures used as store-rooms".[2]

Before we leave the subject of aboriginal habitations, I may note another point of resemblance between Asia and America, in spite of its apparent insignificance. According to Col. N. Prjévalski, who refers to the Mongols among whom he travelled extensively, "même dans l'intérieur de sa iourte, un nomade dira: Tel objet est placé au nord ou à l'ouest".[3] This is exactly the case with the Dénés who, though possessing terms denoting the right or left direction, never use them as we do. When it is a question of position, they invariably resort to such words as denote the points of the compass, even when the distance is insignificant.

Prjévalski also records that "dans la Mongolie orientale, avant de se séparer de son hôte, le voyageur échange avec lui de petites serviettes de soie comme gage de sympathie mutuelle".[4] The Dénés have no such napkins, but we may be allowed to compare the custom of the Mongol with that of the Dené traveller who, before returning home or going on his journey, usually exchanges pieces of attire with his host, as a token of friendship. To come out of a place with the same garments is tantamount to an admission of disregard or contempt on the part of the person visited. It is so carefully guarded against that this mutual exchange of clothing occasionally gives rise to the most ludicrous costume, as the traveller always makes it a point of honour to wear on his return what has been given him.

Another explorer records the following: "In one of the houses which we entered to-day, I observed a child swaddled in a bag which was attached to a board, the whole being a counterpart of the cradle used among the Indians of North America".[5]

[1] "Travels in Kamtchatka and Siberia", vol. i, p. 90; London, 1830.
[2] *Op. cit.*, p. 351.
[3] *Mongolie et Pays des Tangoutes*, p. 45; Paris, 1880.
[4] *Ibid.*, p. 48.
[5] Geo. Simpson, "An Overland Journey round the World", vol. II, p. 129 of American edition; Philadelphia, 1847.

This was among the Yakuts, and I am quoting from Sir Geo. Simpson. Speaking of infants, I may remind the reader of the long suckling practised by the Déné mothers, who quite often give the breast at the same time to two children, one of whom has been walking for a long time. Indeed, I remember a Carrier boy who must have been six or seven years old, at the very least, since he was big enough to learn a certain new hymn which he sang out to me for a consideration, and yet he was sucking his mother!

Now an English traveller among the Kirghis writes of a child of three or four running to its mother to be suckled, and adds: "You would be surprised to see boys of ten and eleven years of age feeding from the mother".[1]

Of the Tungus children the same author says that "they invariably run about naked [in summer] until they are ten or twelve years old",[2] a remark which could not be truer of the children of the old Déné stock.

Face tattooing also prevailed to the same extent among those two aboriginal peoples.

According to Sir Geo. Simpson the Yakuts use "canoes of birch-bark, of the same peculiar shape as those of the Pend d'Oreille River, near Fort Colville",[3] after which he goes on to relate that these canoes "also serve as coffins in the same manner as among the Chinooks and other tribes of the American coast".

The last mentioned craft are, of course, made of wood. They, too, have their equivalents in form and manufacture among the Kamtchadales, if we are to believe Bush, who mentions them as "dug-outs or hollowed logs", the very best description that can be given of the canoes of the Western Dénés.

The same primitive style of embarkation obtains among the Gilacks of the Amoor valley, as is repeatedly stated in a book of travel by a British naval officer.[4]

Bush further states that "to ensure safety when the water is rough, they [the Kamtchadales] lash two or more of them together, side by side, by binding light poles across the tops".[5] I have myself seen many a time canoe rafts among the Babines and Carriers, and Hearne assures us that even the Eastern Dénés used to resort to the same prac-

[1] Mrs. Atkinson, "Recollections of Tartar Steppes and their Inhabitants", p. 178; London, 1863.

[2] *Ibid.*, p. 348.

[3] *Op. cit.*, Vol. II, p. 127.

[4] J. M. Tronson, "A Voyage to Japan, Kamtschatka, Siberia, Tartary", pp. 135, 277, 323; London, 1859.

[5] "Reindeer, Dogs and Snow-Shoes", p. 46.

tice under similar circumstances in connection with their frailer embarcations.[1]

For winter travelling the Western Dénés have, as an adjunct to the snowshoe, which is, of course, of universal use in Asia as well as in America, a peculiar stick with a discoid attachment which prevents it from sinking into the snow.[2] The Gilacks of Eastern Siberia use an identical implement which, according to Bush, "near the bottom has a small hoop fastened around it by a network of deerskin thongs [exactly like its Déné equivalent] which prevents it from sinking into the snow in winter".[3]

The Western Eskimos have also adopted this peculiar staff; but, in his work on "Primitive Travel and Transportation", the late Prof. O. T. Mason deems it of recent introduction in America, as is also the case with the Eskimo and Loucheux wooden snow goggles, which are likewise found in Asia.[4]

Among the Carriers of British Columbia, the snow-stick has a second object which I have thus described: "The hand of the hunter, warm and trembling from the excitement of the chase, if passed through the leather hoop which often accompanies the upper part of the staff, can thereby be steadied and find a reliable support for the barrel of his gun while in the act of firing".[5]

Now here is what I read in a rather little known work: "There is an element of picturesqueness which the Samoyad has introduced into his use of fire-arms: he fires with a gun-rest not unlike that of the old matchlock days. It is made of wood, is about two inches in diameter and four feet long, and reminds you more particularly of a dwarfed billiard-rest".[6]

I am well aware that, from an ethnological standpoint, this little particularity is of no importance. I simply give it as an excellent illustration of the axiom that the same needs create the same means. There still remains the truly aboriginal snow-stick, which is believed to have originated in Asia.

As to fishing on a large scale, that is by means of traps, the same systems and identical contrivances prevail among the Kamtchadales

[1] "A Journey from Prince of Wales's Fort in Hudson's Bay to the Northern Ocean", p. 119; London, 1795.

[2] P. 154 of my "Notes . . . on the Western Dénés" I give a description, with two figures, of this implement such as we find it to-day among the Carrier Indians of British Columbia.

[3] *Op. cit.*, pp. 134-35.

[4] *Op. cit.*, p. 272; Washington, D.C.

[5] "Notes", p. 155.

[6] "The great Frozen Land", p. 80.

and other northeastern Asiatics and the native Americans of the Far Northwest. Sir George Simpson is a witness to this fact when he writes: "While strolling about, I observed in the brook a number of baskets and weirs for taking fish, such as I had seen on the Columbia and in New Caledonia".[1]

The contrivances are, indeed, so much like not only those used by the Indians of those regions, but also those resorted to by my former charge, that Bush and myself described them in exactly the same terms, viz. as "long, funnel-shaped baskets", at a time when I was not even aware of the existence of the former's book.[2]

The American traveller further remarks: "This kind of trap I afterward found in use among nearly all the tribes from the Amoor to the Arctic".

If I mistake not, the reader must by this time concede that there is a wonderful identity between the technology of the American and Asiatic tribes. But this is not all.

VIII.

In Asia, no less than in America, it is chiefly salmon which is the object of the fishing industry. The way it is cured is identical on either side of the Aleutian Islands. In the words of George Kennan, it is "cut open, cleaned and boned by the women with the greatest skill and celerity, and hung in long rows upon horizontal poles to dry".[3]

Apropos of fish and fishing, a remark of Wrangell's, which that explorer applies to the natives of the Lower Kolyma, recalls a foible of the Déné gourmet: his inordinate liking for fish-roe. "As an occasional delicacy", he writes, "they have baked cakes of fish-roe".[4]

The natives here referred to are the Yakuts. Since those nomads are nothing else than an offshoot of the great Tatar race,[5] it may not be out of place to recall in this connection analogies between the latter while "at table" and the North American Indians, especially those of the Far Northwest.

In the first place, both people wash themselves in exactly the same characteristic way, that is, by filling their mouth with water and then

[1] "An Overland Journey", vol. II, p. 348 of English edition. New Caledonia was to the early Hudson's Bay Company traders what is now called British Columbia *minus* the territory south of the Thompson River.

[2] Bush, *op. cit.*, p. 172; Morice, "Notes . . . On the Western Dénés", p. 84.

[3] "Tent Life in Siberia", p. 154.

[4] "Narrative of an Expedition to the Polar Sea", p. 75.

[5] Wrangell, *op. cit.*, pp. 23, 171; Ledyard, "Life and Travels", p. 280; P. Dobell, "Travels", Vol. II, pp. 13, 111.

squirting it over their hands.[1] "On certain rare high days a slight ablution of the face and hands was performed by filling the mouth with water, squirting it out into the hands joined together, and then carrying it to the face", writes F. G. Jackson of the Samoyeds.[2] I have repeatedly seen an identical operation performed among the Tsilkotins, Carriers, Sékanais and Babines.

Then one of the national dishes proper to Asiatics and Dénés alike consists in nothing else than the half digested contents of the reindeer's stomach. Hearne describes it at length as regards the latter,[3] and Bush is no less explicit when he writes of the natives of Siberia.[4]

Another delicacy much esteemed on both continents is the tripes of the hunter's victim. I have repeatedly seen them relished by the Dénés, and, in his remarkable work on the Tatars, the parents of the Yakuts, Abbé Huc shows that the former are not backward in realizing the economic excellence of that part of the animal, which amongst us is scarcely ever thought of when it is a question of human food.[5]

The same author goes on to declare that "tous les Mongols connaissent le nombre, le nom et la place des os qui entrent dans la charpente des animaux; aussi quand ils ont à dépecer un bœuf ou un mouton, ils ne fracturent jamais les ossements".[6] This is to the letter true of the Dené hunters as well.

As to the very mode of eating meat, it is also identical on both continents. Bush says of the Tungus: "Each one taking a huge piece of venison put as much of it as he possibly could in his mouth, and then, by a dextrous up-stroke of his knife, shaved it off close to his lips, the edge barely grazing the end of his nose as it severed the meat. I was in constant dread of seeing one of their noses sliced off".[7]

Before I knew of Bush's work I had written of my own Indians: "The true aboriginal way of disposing of [meat] is to approach the roasting spit, bite into the morsel that is cooking, and cut off the mouthful with a knife. This eaten, the operation is continued, the native repeatedly biting into the piece of meat and cutting off the mouthful at the risk of carving into his own nose".[8]

[1] See Bergeron, *Relation des Voyages en Tartarie.*
[2] "The Great Frozen Land", p. 58; London, 1895.
[3] "A Journey from Prince of Wales's Fort", pp. 317-18.
[4] "Reindeer", etc., p. 344.
[5] *Souvenirs d'un Voyage dans la Tartarie*, Vol. I, p. 360; Paris, 1853.
[6] *Ibid., ibid.*, p. 361.
[7] "Reindeer", etc., p. 281.
[8] "The Great Déné Race", vol. I, pp. 157-58 of reprint from Anthropos, Vienna.

F. G. Jackson records a similar way of eating with regard to the Samoyeds[1] and Prjévalski has the same of the Mongols.[2]

Useless to remark that the native Americans are just as big eaters as the Asiatics and seem endowed with as elastic stomachs.[3] The disgusting habit of absorbing one's vermin is also prevalent among both branches of the human family.[4]

Another of the Dénés' delicacies I described at length, pages 92-93 of my "Notes". This consists of the salmon heads, which are left in the water—I could have added: or buried in the ground, for I have seen many of the pits where they would be left until they had reached an advanced stage of putrefaction. In this state they were boiled in bark vessels by means of hot stones introduced in the receptacle. "The stench they then exhale is simply asphyxiating", I wrote in this connection.

Now hear what an old author has to say of the culinary accomplishments of the Koriacks of Siberia: "In Spring and Summer they catch a large Quantity of Fish, and digging Holes in the Ground, which they line with the Bark of Birch [as do also the Carriers], they fill them with it and cover the Holes over with Earth. As soon as they think the Fish is rotten and tender, they take out some of it, pour Water upon it, and boil it with red-hot Pebbles, . . . and feed upon it as the greatest Delicacy in the World. This Mess stinks so abominably that the Rus-

[1] "The Great Frozen Land", p. 75.

[2] "Les Mongols mangent avec leurs doigts et enfoncent dans leur bouche d'énormes morceaux de viande, qu'ils coupent avec leur couteau au ras des lèvres" (*Mongolie et Pays des Tangoutes*, p. 40).

[3] "The improvidence of these natives is equally astonishing as their ravenousness. They will consume nearly a week's provisions in one night and go hungry the remaining six days" (Bush, *op. cit.*, p. 230). See also Simpson, "An Overland Journey", vol. II, p. 309 of London edition. An Apache (Déné) woman is on record as having consumed in one meal all the rations she had received from the Government for one week (See Fourteenth Ann. Report Bureau of Ethnology, p. 287). Of the Kirghis of Siberia Mrs. Atkinson writes the following: "They are a peculiar race of people, being able to remain two, and sometimes three, days without eating, and then the quantity they can eat is enormous. I was told that a man can eat a sheep at once; on making the enquiry among the Kirghis, one of them offered to treat me with the sight if I would pay for it, but I declined witnessing the disgusting feat" ("Recollections of Tartar Steppes", p. 179). As to the Mongols, here is what Prjévalski writes of them: "La gloutonnerie de cette race est extraordinaire: un individu consomme dix livres de viande dans une journée, et certains gastronomes font disparaître un mouton de taille moyenne dans le même espace de temps. En voyage, la ration de chaque chamelier est d'une cuisse; il est juste d'ajouter qu'il jeûne vingt-quatre heures si cela est nécessaire, mais quand il mange, il mange comme sept" (*Mongolie et Pays des Tangoutes*, p. 39).

[4] Prjévalski, *op. cit.*, p. 38.

sians who deal with them, and who are none of the most squeamish, are themselves not able to endure it".[1]

Another article of diet, which is not so repulsive to a civilized palate or nostril, but yet quite as novel to either, is the sap of certain coniferous trees, which is relished by both Yakuts and Western Dénés. "In February and March is their Harvest, when the Sap rises in the Trees", writes of the former the author just quoted from; "for they go into the Woods, cut down young Pine-Trees, take off the inner Bark or Bast, which they carry home and dry for their Winter's Provision".[2] The same can be said of the Northwest American Indians, with this only qualification that they do not cut the trees down, but shave off the sap with special bone implements.

Strange to say, the very relatives of the people who are so disgusting in their diet cannot stand the sight of clean fish or water-fowl. According to Prjévalski, "la répugnance du Mongol â cet égard est telle qu'une fois, sur les bords du lac Koukou-Nor, nos chameliers nous voyant manger une sarcelle furent pris de vomissements".[3]

Compare this repugnance of an Asiatic tribe for water animals with the quite as great aversion entertained therefor by the Navahoes and Apaches, the two principal divisions of the Southern Dénés. This peculiarity among them is so striking that it was made the subject of a paper in the "Journal of the American Folk-Lore" by the late Washington Matthews, who wrote, among other things:

"I found that the Navahoes not only tabooed fish, but all things connected with the water, including aquatic birds. Speaking of the Navaho repugnance to fish with the landlady of the Cornucopia Hotel (a slab shanty) at Fort Wingate, she related the following as a good joke on the Indian. She employed a young Navaho warrior to do chores around her kitchen. The Navaho warrior has no pride about the performance of menial labour. He will do almost anything at which he can earn money, and this one would do any work for her but clean fish. He would eat, too, almost anything in her kitchen except fish. Noticing his aversion to the finny tribe, she one day sportively emptied over his head a pan of water in which salt fish had been soaked. The Indian screamed in terror, and, running a short distance, tore in haste every shred of clothing from his body and threw it all away. She learned that he afterwards bathed and 'made a lot of medicine' to purify himself of the pollution. He never returned to work for her, so this little trick cost her a good servant".[4]

[1] S. Muller, *op. cit.*, p. IX.
[2] *Ibid.*, p. III.
[3] *Op. cit.*, p. 40.
[4] "Ichthyophobia" (Journal of American Folk-Lore, p. 106).

INTERIOR OF KORAICK YOURTEL—GETTING FIRE WITH THE FIRE DRILL

The question of food and cooking predicates that of fire-making. S. Muller writes in the work already quoted that a certain traveller named Steller "came to a place where the [native] Americans had but just before dined, but on sight of him were run away. There he found an arrow and a wooden instrument to procure fire made in the same manner as they have them in Kamtschatka".[1]

IX.

I know perfectly well that the sceptic has long been in wait for me with the remark that such technological and sociological analogies are of little weight in the balance of the serious ethnologist; for, as is well known, the same needs create the same means. Man, placed under similar conditions, will instinctively resort to identical methods of relieving his wants.

I grant the force of this objection, and freely admit that, while the points of resemblance between American and Asiatic peoples are overwhelmingly convincing to the general reader, because of their very number, I do not see in all those I have already enumerated direct and absolute evidence of a common origin, though past intercourse would seem to be suggested thereby. Some there are, as, for instance, the existence of the fire-drill, which, apart from a similarity of details in its construction, do not prove much more than an identity of needs obviated by the same reasoning animal. Others, as the way of preparing fish by putrefaction, do not seem to answer such an evident human need, and may be considered good evidence in favour of, at least, past intercourse between two different peoples.

At all events, it cannot be denied that, owing to their number and the nature of many of them, those analogies afford at least a confirmation of the argument derived from aboriginal traditions and geographical terminology.

I shall now proceed to enumerate similarities which have nothing to do with man's needs or environment, purely psychological and sociological facts, which are bound to point to a community of race or relations between ancient Asia and America—Palæo-Asia and America, as I think it is now fashionable to put it.

I shall, however, commence this section of my paper by treating of a few points, such as the disposing of the dead and others, which may, strictly speaking, be described as holding a middle place between the

[1] S. Muller, *op. cit.*, p. XLIII. The same traveller also found an underground hut with a store of red salmon "and a sweet herb which is dressed for food *in the same manner as in Kamtschatka*" (*Ibid., ibid.*).

foregoing and the following series of data, though they are not entirely devoid of all connection with the peculiar working of the mind.

We read that, among the Yakuts, "some put the corpse upon a Board, which they fix upon four Posts, in the Wood, cover the dead Body with an Ox's or Horse's Hide, and so leave it . . . But the greater Part of them, when they die, are left in their Huts, whence the Relations take the most valuable Things, make the Huts close, and then leave them".[1]

Both kinds of "funerals" apply to the Sékanais and most of the many eastern tribes of Dénés. Of the former I wrote, over twenty-five years ago, that, on the occasion of the demise of a fellow man, "they would lower his hut down upon him and thus cover his remains, and start at once for another locality",[2] or then suspend them "on the forks formed by the branches of two contiguous trees", when they have not recourse to four independent posts in exactly the same way as the natives of Siberia.

Of the Eastern Dénés, the Anglican Bishop W. C. Bompas states that, instead of burying their dead, they were formerly accustomed to "place them on high scaffolds above ground".[3]

Again, all American sociologists are familiar with the particular aerial "burial" formerly in vogue among the Chinooks and other North Pacific coast Indian tribes. These were wont to enclose the dead in one of their wooden canoes, and lay them up in the branches of a tall tree. Now here is what we read in a book by an English officer, who wrote *de visu* of the Gilacks, or Ghiliacks, as he calls them:

"Their mode of burial is unlike any other that I am acquainted with; the body is placed in a rude coffin made from a log of wood, in a manner similar to that adopted in making their canoes, and covered over with bark, bound round with osiers; it is then placed between the forked branches of a tree, out of the reach of any animal that might be attracted to the spot".[4]

We have already seen that all of the modes of self-adornment in use among the American aborigines have their exact counterparts in the wilds of Siberia. Now as to the personal appearance of the people that roam through them.

In 1826, two young chiefs of the Tungus were taken to Rome by two Jesuits who had converted them to the Christian faith in their

[1] S. Muller, "Voyages from Asia to America", p. 111.

[2] "The Western Dénés; their Manners and Customs", p. 146 (Proceedings of the Canadian Institute, 3rd Series, Vol. VII; Toronto, 1890).

[3] "Diocese of Mackenzie River", p. 91; London, 1888.

[4] J. M. Tronson, "A Voyage to Japan, Kamtschatka, Siberia, Tartary", p. 324.

native country. "It must be acknowledged that their complexion was fairer than that of the Indians—in many cases it is not—but in every other respect there was a singular coincidence".

"The diligent antiquarian, Count Rosetti, who travelled some years since in the United States, was so perfectly satisfied with their identity that he published, on the arrival of the young princes at Rome, an able article for the Society of Antiquaries, proving the Asiatic origin of the North American Indians. To confirm his assertions, he brought before the Society of Antiquaries the two Asiatic princes and an Indian who had accompanied him from America to Italy. During this enquiry, some of the most literary men in Italy were present, and among them we observed two or three foreign ambassadors. The sameness of people was at once acknowledged by the society".[1]

As to the costume, we may add that the same Rosetti compared his Indian dress, in which he appeared once at a mascarade ball in Rome, with the dresses of the two Tungusian chiefs, the converts of a Father Santini, and the resemblance was striking.[2]

One little feature which I deem characteristic I cannot fail to mention in this connection. According to the aforesaid Father Santini, a man of good education who spent many years among the aborigines of northeastern Siberia, "ogni parte del loro vestito era abellato colle penne del porco spinosa",[3] that is, for those who do not read Italian, "every part of their dress was embellished with coloured porcupine quills",

[1] Quoted by John McIntosh, "The Origin of the North American Indians", p. 92; New York, 1853.

[2] According to Abernethy quoted by McIntosh (*op. cit.*), the original costume of the Tungus, Koriacks and Kamtchadales consisted in an upper garment of furs, with a hood and sleeves, just as that which was worn by the Eastern Dénés (Cf. Petitot, *passim*). "From the knees downward they are", he says, "covered with leggings of deer or buffalo skin; their shoes are also made of the same. These robes were formerly dressed with the hair on; but the Tongusi, especially, and the Coriacks have made themselves so well acquainted with the art of tanning, that hair is not seen in any part of their dress, except the hood, the neck and the cuffs of the sleeves of the upper garment" (*Ap.* McIntosh, *op. cit.*, p. 116). The pendants in their ears and nostrils are usually shells, which are painted on one side with a red, and on the other with a blue, colour; but they never consider themselves in their full uniform without a crown made of the plumage of a bird called the *rotoo*" (*Ibid.*). According to the missionary Santini, the Tungus, "in their original state of barbarity were dressed in skins; they painted their bodies and faces with various colours; they bored their noses and ears, whence hanged coloured shells. For their head covering they had crowns made of the skin of a young deer, ornamented with the plumage of rare birds" (*Ibid.*, p. 117). Who has not recognized in this description one of the original lords of the immense American plains or forests?

[3] *Apud* McIntosh, *op. cit.*, p. 118.

exactly in the same way as that of my former charge, the Tsilkotins, Carriers, Babines, Sékanais and Nahanais of northern British Columbia.

These are, indeed, quite distinctively American features!

Does the incredulous wish for some more? He is, no doubt, familiar with the role played by the famous calumet of the American plains in deciding war or peace. This he will admit is quite characteristic of our aboriginal population. What will he think when he is told that it was formerly as common, and had the same significance, on the tundras of E stern Siberia as on the prairies of North America?

Here is the translation of what Santini has to say in this connection. This time he refers to the Koriacks:

"When a nation is inclined to make peace, they light the sacred pipe, and it is offered by a chief to the commander of the hostile tribe; if he receives and smokes it, peace is immediately proclaimed, and so sacred do they consider this agreement, that they have been seldom or never violated. The bowl is made of clay, and the tube of a reed three or four feet long, it is decorated with feathers of various colours. They have their different pipes for their different sorts of contracts".[1]

This brings us to the subject of war. According to Abernethy, the Tungus braves prepare themselves therefor just in the same manner as the Blackfeet and others. Here is what he writes:

"In order to ascertain the courage, patience, and perseverance of their warriors, [they] inflict many injuries and insults on the young people who never faced an enemy. They first reproach them with the names of cowards; they beat them with their clubs, and even throw boiling water on them; and if they show on these occasions the least impatience and sensibility, they are reckoned as dastards who are not worthy of the name of warriors. They carry this practice of trying the young men so far that it would be too tedious to relate them".[2]

Hostilities among the Palæo-Asiatics commenced and were conducted in the same way as among the American Indians, especially those of the north.

"It is generally about day break that they attack their enemies, because about this time they imagine that they are asleep", writes Abernethy. "The chief gives the signal, and they all rush forward, discharging their arrows, and preparing their more deadly weapons, their *tomahawks*. Slaughter and destruction are now committed with-

[1] *Ibid.*, p. 155.
[2] *Ibid.*, p. 150.

out mercy or compassion, and the vanquished frequently undergo the painful operation of *scalping*".[1]

X.

We now come to evidence of former intercourse, or community of origin, between native Americans and Asiatics which I consider conclusive, because it is of a purely psychological order and could not have been influenced by the requirements of physical needs or environment.

We all know that in northeastern Siberia and northwestern America there is but one religious system, shamanism, and that the various observances that flow therefrom are common to both countries. Northern Asia has always been considered the original home of shamanism, and therefore the different American peoples that follow it must have had at least intercourse in times past with the aborigines of that region.

According to that system, the constitutive parts of the visible world are the abode of as many spirits, some of which are good—hence the totems—others of a noxious nature—hence disease and material or moral adversities. The whole is too well known for me to dwell on it.

We should therefore not be surprised to read in the relation of a prominent traveller through Siberia that "as every locality has its own elf, the Yakuti, when on a journey, have no respite, soothing one object of terror after another".[2]

This soothing is done chiefly by means of offering. "In the branches of the trees along the road were suspended numberless offerings of horsehair", remarks the same traveller.

One who followed in his footsteps found similar tokens of the natives' faith in ubiquitous spirits at a place called Coeil,[3] while, writing of the Kamtchadales, an author much older than both of those I have just

[1] *Ibid.*, p. 151. Compare with the above what two old English authors say of the wars of the Kamtchadales. I quote from the French translation in my library: "Ces guerres se font avec plus de ruse que de bravoure. Ils sont très lâches et n'osent pas paroitre avec fermeté devant un ennemi. Ceci est d'autant plus extraordinaire qu'ils méprisent la vie hautement, et que le suicide est fort commun parmi eux. 'Leur attaque se fait par des attaques nocturnes d'autant plus faciles qu'ils ne tiennent jamais des gardes. Le plus petit parti peut ainsi détruire un village entier. Ils n'ont qu'à mettre un seul homme devant la porte de chaque cabane, et ne laisser sortir personne. Le premier qui s'avise de s'échapper est facilement massacré ou fait prisonnier" (*Description abrégée du Pays de Kamtschatka*, pp. 67-68; Erlang, 1768). No description of the way of making war obtaining among the Western Dénés of old could be more correct than that of those two authors, Grieve and Jefferys, despite the fact that they intend it for an Asiatic, not an American, nation.

[2] Geo. Simpson, "An Overland Journey", Vol. II, p. 115.

[3] J. Bush, "Reindeer, Dogs and Snow-Shoes", p. 351.

referred to has the following: "Dans une vaste plaine ils érigent un haute palissade, autour de laquelle ils attachent des haillons. Quand ils y passent, ils y jettent quelque poisson ou autres vivres".[1]

The same goes on to say that, "outre ces palissades ou perches, il y a encore d'autres lieux saints chez eux, par exemple, les volcans, les sources chaudes et certains bois qu'ils croyent être habités par des démons, qu'ils adorent et craignent plus que Dieu".[2]

This latter remark of the old author tallies quite well with the well-known fact that, among shamanistic peoples, a good deal more of attention is paid to the evil spirits, whose malefic influence is feared, than to the Supreme Being, who is known to be animated by none but the best of intentions towards man.

Other tribes venerate more or less curiously shaped or prominent rocks in the forest or on the shore of lakes, and would never pass by without making thereto some sort of offering, were it only the merest pebble picked up from among the dust of the highway—in exactly the same way as I have seen it done by the Western Dénés before they had seriously embraced Christianity.

The traveller P. Dobell writes in this connection: "We soon arrived at a large rock, where our guide told me there was a cave . . . which, he said, if we were to pass without leaving something . . . we should certainly be unfortunate. The moment we came opposite the rock, the party stopped, and the Karaikees (*sic* probably for Koriacks) to a man, even those who professed to be Christians, went and left a pinch of snuff, a leaf of tobacco, a pipe, or something or other, as an offering".[3]

T. W. Atkinson found on Lake Baikal the same superstitious respect paid to prominent rocks. He writes of one of them: "It is held sacred by all of the Shaman creed, and they never pass it without offering their devotions. Rude figures have been sculptured upon its surface, and

[1] Grieve and Jefferys, *Description abrégée du Pays de Kamtschatka*, p. 10.

[2] *Ibid.*

[3] "Travels in Kamtchatka and Siberia", vol. I, 138. In this case the offering is said to have been made to the shade of a famous conjuror who had dwelt there; but absolutely similar instances are recorded, when the spirit of the rock itself was intended to be propitiated. Compare with this what Hearne saw among the American Dénés on his way to the Frozen Ocean: "By the side of this path", he says, "there are in different parts several large, flat, or table stones, which are covered with many thousands of small pebbles. These the Copper Indians say have been gradually increased by passengers going to and from the mines [of native copper]; and on its being observed to us that it was the universal custom for every one to add a stone to the heap, each of us took a small stone to increase the number, for good luck" (*Op. cit.*, pp. 132-33). Hearne is in this passage as naive as usual. He stooped to a superstitious observance probably without as much as suspecting it. Yet he admits that his pebble was deposited on the big stone "for good luck"!

THE BEAR SHAMAN SMELLING THE WATER

formerly both men, women, and children have been offered up on its summit, or hurled into the flood".[1]

The same traveller found in another place rocks and a supposed tomb on which, he says, the Kirghis looked "with veneration". Speaking of his companions, he adds that "each left a strip of his garment on the grave as an offering".[2]

Sometimes the object of that coarse worship is a mere heap of stones, which is being constantly added to, like those which Huc noticed in Tartary, where, he says, they are quite numerous.[3]

It is the same belief in the ubiquity of spirits and their intimate relation to man that prompts the reverence paid to the animals of which the native stands in need, and the care with which their remains are treated by him. We read of the Yakuts: "They bowed reverentially towards bruin's favourite haunts, with appropriate accompaniments in prose and verse, lauding his bravery and generosity to the skies, recognizing him as their beloved uncle, and endeavouring by every means to coax him into forbearance".[4]

This is from the pen of Sir Geo. Simpson. Another writer has the following concerning the Kamtchadales: "Les habitans ont en usage des cérémonies puériles â l'égard des têtes de ces animaux [seals], auxquelles ils témoignent autant de respect qu'aux meilleurs amis. L'auteur a vu une de ces cérémonies en 1740".

After having described the ceremonious treatment meted out to the spoils of those animals, the author goes on to remark that all this was done "afin que les autres chiens marins puissent voir avec quel respect ils traitent leurs amis et se rendent ainsi d'autant plus volontiers à eux".[5]

This is an excellent explanation of a particularity concerning bears' heads or skulls, which all travellers in Asia and America have noticed, without, in some cases, being able to grasp its real significance. Thus Bush says that, among the Gilacks of Siberia, "upon all sides, scattered through the woods, were skulls of bears poised upon the stumps of small trees, from four to six feet above the ground. These", he adds, "were intended as some kind of offering to the native gods".[6]

I make bold to assert that in this our author is mistaken.[7] The intention of the natives must certainly have been the same as it is among

[1] "Travels in the Region of the Upper and Lower Amoor", p. 382.

[2] *Ibid.*, p. 118.

[3] Huc, *Souvenirs d'un Voyage en Tartarie*, Vol. I, p. 40.

[4] Simpson, *op. cit.*, Vol. II, p. 119.

[5] Grieve and Jefferys, *op. cit.*, pp. 43-44.

[6] *Op. cit.*, p. 124.

[7] In the first place, the fact that Bush refers to "gods" bespeaks on his part very little familiarity with the religious system of the Asiatics.

those of America (and, indeed, of Kamtchatka, as we have just seen). Our Indians follow an exactly similar custom: they put the bears' head out of the reach of dogs or wolves, unclean animals with which contact is defiling and therefore humiliating for the whole bear gens, which would not fail thereafter to avoid giving the careless hunter another opportunity of allowing such unbecoming treatment.

Apropos of game and hunting, such of my present readers as may be familiar with my previous writings will perhaps recollect how sharply the hunting grounds of the Western Dénés are divided, and what religious attention must be paid to the traditional delimitations of the same. Now John Ledyard writes of the Tungus that "they, and the other roving Tartars, have the limits of their hunting grounds ascertained and marked like the aborigines of North America".[1]

Another point of the native sociology seems identical, or at least very similar, on both Asiatic and American continents. As long as twenty-six years ago, I wrote in my first published paper on the Dénés a rather elaborate account of the various *potlatches*, or ceremonial banquets, in vogue among the Carriers and Babines. Such feasts were no less in honour among the original Kamtchadales, if we are to believe two joint authors I have already quoted. They write: "Les fêtes de réjouissance se font à l'occasion d'une nôce, ou d'une heureuse chasse, ou d'une pêche abondante, à laquelle un village invite ses voisins fort cérémonieusement. Ils traitent leurs hôtes avec une si grande profusion et ceux-ci mangent avec tant d'excès qu'ils sont presque toujours forcés de rendre".[2]

The reader may compare this statement with what I wrote on "The Western Dénés; their Manners and Customs".[3]

The funeral or remembrance of a departed friend is, among my former Indians, the chief occasion of such public feasting. Something akin thereto obtains among the Kirghis of Siberia, as we gather from a perusal of Atkinson's Travels. We see therein that one of those feasts "continued for seven days, during which other Sultans and Kirghis were constantly arriving. It was supposed that near 2,000 people assembled to assist at the funeral".[4]

[1] John Ledyard, "Memoirs", p. 316. Amongst the Dénés of old, the wolverine, if caught, would be skinned alive, probably as a punishment for its misdeeds, for it is a great thief and a perfect nuisance to the trapper (Petitot, *Autour du Grand Lac des Esclaves*, p. 318), while, speaking of wolves, Huc says that, among the Tatars, "on écorche l'animal tout vif, puis on le met en liberté" (*Op. cit.*, vol. i, p. 134 of 1854 edition).

[2] Grieve and Jefferys, *op. cit.*, pp. 73-74.

[3] Proceedings of the Can. Inst., 3rd Series, Vol. VII, pp. 147-53.

[4] *Op. cit.*, p. 65.

Speaking of funerals we are reminded of those monuments which are often raised to perpetuate the memory of the departed ones. All of my readers are, no doubt, aware of the existence of the earth mounds which cut such a figure in the archæology of the great American plains. But the same obtain in Siberia, as can be ascertained by a reference to pp. 86, 151 and 191 of Atkinson's "Travels".

From funerals to popular amusements there seems to be a long cry. Not so, however, with aboriginal races, which very often blend them together. The amusements of the Kamtchadales seem to be a duplicate of those in vogue among the primitive Americans. Grieve and Jefferys write in this connection:

"Toutes leurs réjouissances consistent dans la danse, dans le chant et dans divers autres amusemens. Deux femmes qui veulent danser mettent à terre une natte au milieu de la cabane, prennent un peu de filasse dans chaque main, se mettent à genoux sur la natte vis-à-vis l'une de l'autre. Au commencement elles chantent fort doucement, en faisant un peu mouvoir leurs épaules et leurs mains. Puis elles augmentent peu à peu la vivacité des mouvements de tout le corps et élèvent leurs voix jusqu'à ce qu'elles tombent enfin hors d'haleine. . .

"Un autre passetemps des femmes de Kamtschatka c'est de contrefaire les gestes et les paroles des autres, par moquerie. . .

"Toutes ces réjouissances se font ordinairement la nuit. Ils ont même des bouffons de métier; mais leurs fanfaronnades sont insupportables, indécentes et destituées de pudeur".[1]

Each and every one of these points apply to the Western Dénés.

XI.

But I wander from the spirits of the Asiatic and American shamanists. These manifest themselves to individuals chiefly by means of dreams. Hence the great importance those aborigines attach thereto. "Ils sont grands observateurs des songes", we read of the Kamtchadales.[2] "They also attached to dreams the same importance as did most peoples of antiquity", I wrote myself of the Western Dénés. "It was while dreaming that they pretended to communicate with the supernatural world, that their shamans were invested with their wonderful power over nature, and that every individual was assigned his particular *nagwal*, or tutelary animal-genius".[3]

[1] *Op. cit.*, pp. 74-75.

[2] Grieve and Jefferys, *op. cit.*, p. 72.

[3] "The Western Dénés, p. 161 (*ubi suprà*).

Of the shaman and his attributions I need only say that both are essentially the same in America as in Siberia. This is a well-known fact; useless to insist. We are all aware that the shaman's main office in the former country was to drive off the body of the sick the evil spirit which was reputed the cause of his ailment. See the counterpart of this in Asia:

"D'après l'opinion religieuse des Tartares c'est toujours un *Tchutgour*, ou diable, qui tourmente par sa présence la partie malade",[1] and this devil, or spirit, is everywhere cast out(?) of the body by means of a like exorcism.

It is also this belief in spirits that accounts for the system of totems, at least in both Siberia and North America, whatever Messrs. J. G. Frazer, Andrew Lang and others of the European school may have written to the contrary. Thus we read of the Yakuts that "each Tribe of these People looks upon some particular Creature as sacred, *i.e.* a Swan, Goose, Raven, etc., and such is not eaten by that Tribe, though the others may eat it".[2]

In the second volume of his monumental work on "Totemism and Exogamy", J. G. Frazer has it that "the two tribes, the Chukchecs and the Koryacks, who inhabit the part of Asia nearest to America, appear to be entirely without both totemism and exogamy, the two great institutions so characteristic of the North American Indian".[3]

I have not made of this question an exhaustive study; yet I dare say that the erudite author is mistaken as regards both Tchuktchis and Koriacks—at least if we take totemism in the American sense of the word.[4] Being to him a mere social system, without any necessary connection with the religion of a people, totemism is, in his estimation, a correlative of exogamy. But, as I understand the former, it is not necessarily related to matrimonial alliances or descent, and, though we find in America many tribes in what I consider to be the secondary stage of social organisation, matriarchy, who practise exogamy because they have adopted the gentile system and consequent tribal totems, those who have not outgrown that primary stage of human society, which I believe to have been patriarchy, generally do not know of these, but are quite familiar with the individual or personal totem.[5]

Now the Tchuktchis certainly know of the latter, in common with all the more primitive and unadulterated Dénés, who never heard of the

[1] Huc, *Souvenirs d'un Voyage en Tartarie*, Vol. I, p. 121.

[2] S. Muller, "Voyages from Asia to America ', pp. III-IV.

[3] "Totemism and Exogamy", Vol. II, p. 348; London, 1910. See also A. Lang, "The Secret of the Totem"; London, 1905.

[4] Perhaps even though we were to take it in the sense of the English school.

[5] This personal totem the English school calls the manitou.

former. For no less an authority than Wrangell tells us, with regard to a certain Tchuktchi chief he saw, that "his cap was much ornamented with beads and ear-rings, and surmounted by a large raven's head, which he told us would ensure us a fortunate journey and a good reception".[1]

The raven was evidently the personal totem of that chief, and we are perhaps warranted to infer from Wrangell's last words that it was also the totem of at least a particular clan among the people to whom they were going. It is well known that community of clan, denoted by an identity of totem, invariably ensures the most brotherly reception in any strange place.

As to the Koriacks, among whom Frazer likewise fails to see any trace of totemism, here is what I read in an old English author. Abernethy refers to their dress: "The tanned covering", he says, "is generally painted with considerable taste. The figures represent those animals which have been chosen by each tribe as their distinguishing marks".[2]

Here, therefore, we have, not only personal, but tribal, totemism.

The same author says of those Asiatics when on the war-path: "The Coriaks have their tutelar deities which they carry with them on these expeditions. These symbols under which every one represents his familiar spirit, are painted with various colours, and carried in sacks. When they travel by water they place the sacks which contain them, their presents, and other valuable articles in the fore part of their canoes, where the chief sits with no other intention, I suppose, than that of honouring them".[3]

[1] "Narrative of an Expedition to the Polar Sea", p. 349. Since the above was written I have found the following concerning the same subject in the Proceedings of the Eighteenth International Congress of Americanists. It is from the pen of a Russian who lately studied systematically the inhabitants of the Aleutian Islands and of Eastern Siberia. "Every ancient Aleut has his animal protector or *ugdua*, received from his father or some other relative or shaman, which was in the shape of an animal's skin, to be put on that he might be transformed into the corresponding animal in case of danger, struggle, or contest" (W. Jochelson, "Riabouschinsky Expedition to the Aleutian Islands", p. 340). The reader will remember that, according to Petitot's informants, the Dénés formerly lived in the midst of a people whose men had the faculty of transforming themselves into animals. We have seen that the other attributes of that wonderful nation, such as their cuirasses, their wooden helmets, etc., tally to perfection with what we learn of the ancient Aleuts and their neighbours. In the light of what Jochelson now tells us, those people must have boasted the power of assuming the shape of their protecting animal; might not this be another link in our identification of the Dénés' traditional enemies?

[2] *Apud* McIntosh, "The Origin of the North American Indians", p. 116.

[3] *Ibid.*, p. 151.

Compare this with this passage from Hearne, which refers to the way his Déné companions prepared themselves for the famous Massacre of Bloody Falls, that is, for "war" as they understood it:

"When we arrived on the West side of the river, each painted the front of his target or shield, some with the figure of the Sun, others with that of the Moon, several with different kinds of birds and beasts of prey, and many with the images of imaginary beings, which, according to their silly notions, are the inhabitants of the different elements, Earth, Sea, Air, etc.

"On enquiring the reason of their doing so, I learned that each man painted his shield with the image of that being on which he relied most for success in the intended engagement. Some were contented with a single representation, while others, doubtful, as I suppose, of the quality and power of any single being, had their shields covered to the very margin with a group of hieroglyphics quite unintelligible to every one except the painter".[1]

On the other hand, if we are to take totemism in the same sense as Mr. Frazer, then we will say that if this was really wanting among the Asiatic tribes nearest to America, it is a further trait of resemblance with the northernmost Americans, who do not know of what I call social totemism and its consequent system of clans, endogamy or exogamy.

XII.

As to the contracting of marriage, if the taking of a woman to wife can be so called when it is a question of primitive peoples, I have written that, among the Carriers—and I might have added the Tsilkotins, the Babines and the Western Nahanais—"the intended wife had absolutely nothing to say for or against the projected union",[2] not any more than is the case with her sisters among the Kirghis of Asia,[3] and that this latter happy consummation was the result of two or three years' arduous work on behalf of the parents of the girl, with whom he would live as a son during the stage preparatory to his marriage.

The same custom prevails among the Kamtchadales, where the suitor of a particular maiden "asks her parents permission to serve them for a time with a view to get her".[4]

[1] "A Journey from Prince of Wales's Fort to the Northern Ocean", pp. 148-49.
[2] "The Western Dénés, their Manners and Customs", p. 122.
[3] Prjévalski, *Mongolie et Pays des Tangoutes*, p. 208.
[4] Grieve and Jefferys, *Description abrégée du Pays de Kamtschatka*, p. 77.

A KORIACK GIRL

According to P. Dobell, this custom is just as prevalent among the tribe he calls the Karaikees. That author describes it very graphically when he writes: "Should a young man fall in love with a girl, and that he is not rich enough to obtain her by any other means, he immediately enslaves himself to her father as a servant for three, four, five or ten years, according to agreement before he is permitted to marry her. When the term agreed on expires, he is allowed to marry her, and live with the father-in-law as if he were his own son. During the time of his servitude, he lives on the smiles of his mistress, which ought to be very benignant to enable him to endure so long the frowns of an imperious master, who never spares him from the severest labour and fatigue".[1]

Of probably the same Siberian tribe Geo. Kennan writes: "The young Korak's troubles begin when he first falls in love. . . He calls upon the damsell's father and . . . is probably told that he must work for his wife two or three years. . . He goes cheerfully to work . . . and spends two or three years in cutting and drawing wood, watching reindeer, making sledges, and contributing generally to the interests of his prospective father-in-law".[2]

Another mode of winning over a girl in Northern America is to wrestle for her. Hearne, Mackenzie, Hooper,[3] Richardson, Keith, Masson and others are authorities for this. Hence the importance of the art of wrestling among the natives of that country.[4]

Now we are told that, on the day of a Tatar's wedding, a simulated combat takes place, which ends in the bride being carried off by the bridegroom. "Les envoyés du futur étant sur le point d'arriver", writes Abbé Huc, "les parents et les amis de la future se pressent en

[1] "Travels in Kamtchatka and Siberia", p. 82.

[2] "Tent Life in Siberia", pp. 192-93.

[3] "The Tents of the Tuski", p. 303. That author depicts vividly one of these wrestling bouts, which used to decide the fate of a woman even after she had been "married". "If", he says, "a man desire to despoil his neighbour of his wife, a trial of strength of a curious nature ensues: they seize each other by the hair, which is worn long and flowing, and thus strive for the mastery, until one or another cries *peccavi*. Should the victor be the envious man, he has to pay a certain number of skins for the husband-changing woman, who has herself no voice in the matter, but is handed over like any other piece of goods, and generally with the same unconcern". Hearne's party through the great northern wastes having fallen in with a young woman who had lived alone for a number of months, a similar contest ensued as a matter of course. "The singularity of the circumstance", writes the explorer, "the comeliness of her person and her approved accomplishments occasioned a strong contest between several of the Indians of my party, who should have her for a wife; and the poor girl was actually won and lost at wrestling by near half a score different men the same evening" (*Op. cit.*, p. 265).

[4] Huc, *Souvenirs d'un Voyage en Tartarie*, Vol. I, 119.

cercle autour de la porte, comme pour s'opposer au départ de la future. Alors commence un combat simulé, qui se termine toujours, comme de juste, par l'enlèvement de la future".[1]

With the Kamtchadales some such struggle likewise marks the occasion; but this time it occurs between the suitor and the future bride's friends, as we gather from the narrative of Grieve and Jefferys. "Les femmes qui sont présentes se jettent sur lui", they declare, "le battent, le tirent par les cheveux, l'égratignent dans le visage, et enfin le maltraitent en toute façon pour l'empêcher de réussir".[2]

Other American tribes simply take their wife by force, just as the Tangoutes of Siberia, who, according to Prjévalski, "sont dans l'usage d'enlever celle qu'ils désirent avoir pour épouse".[3]

We also read in a recent work concerning the Yukaghirs, who are perhaps the most moral (!) of the Palæo-Asiatics, that "a girl having reached the age of puberty, is given a separate sleeping-tent, and becomes quite free to receive visitors. When the lights in the houses of the Yukaghir are put out and the people retire, the youths quietly leave their homes and find their way to the tents of the neighbouring girls. Unmarried young men very rarely pass their nights at their own homes. . . . When a young man finds a rival in the girl's tent, he compels him to come out and fight. The vanquished one goes off home, and the conqueror re-enters the tent".[4]

The Gilacks' treatment of a young mother is exactly on a par with that but yesterday meted out to a woman so situated all over North America. "During parturition", writes Bush of the northeastern Asiatics, "whether in winter or summer, the unfortunate mother is ejected from her habitation—thrust out of doors, exposed to the inclemency of the weather, there to provide for herself as best she may, solitary and ignored, until a certain period shall have elapsed".[5]

I am free to remark that this particular is, however, no great evidence of community of origin or of previous intercourse, for we find it practically with all the primitive races. It belongs to another set of rather numerous observances over which I shall pass, and which have a wonderful resemblance to the prescriptions of the Mosaic law.

The same cannot be said of another custom which prevails alike among the Northern Dénés and the Palæo-Asiatics. The former, who may be compared to grown-up children, are by nature very gay and

[1] *Ibid.*, *ibid.*, p. 312.
[2] Grieve and Jefferys, *op. cit.*, pp. 77-78.
[3] *Op. cit*, p. 208.
[4] W. Jochelson, "The Yukaghir and the Yukaghirized Tungus"; New York, 1910.
[5] "Reindeer, Dogs and Snow-Shoes", p. 102.

expansive. Hence their great foible for singing. Their songs I characterized in a former paper as "little more than polished yells";[1] yet they have at least one merit, that of originality. Although their "melody" always follows a certain strain proper to aboriginal music, both tune and words are of the singer's own composition. Especially is this the case when it is a question of those which may be described as love-songs.

"The women," writes W. H. Dall of the Yukon Indians, "are fond of making up songs of their own, which they hum over their work. Some of these are full of sentiment and not unworthy of preservation. The chorus always forms a prominent part".[2]

Now Wrangell says of the Yukaghirs, a Siberian tribe of the Anini valley: "They are passionately fond of music . . . Their singing is quite peculiar and wild; but, after the ear becomes accustomed to it, it is not unpleasing. They generally improvise both the words and the air"[3]

On the other hand, we read of the Kamtchadale women that "dans leurs chansons galantes elles découvrent à leurs amans leurs craintes, leurs espérances et d'autres passions; ce sont encore les femmes qui en composent les airs".[4]

I make bold to observe that such a sociological trait is of a purely psychological nature, and has nothing to do with environment. Its propriety as a basis for an ethnological argument is, of course, all the greater.

[1] "The Western Dénés", p. 156.

[2] "Travels on the Yukon and in the Yukon Territory", p. 198; London, 1898.

[3] "Narrative of an Expedition to the Polar Sea", p. 182.

[4] Grieve and Jefferys, *op. cit.*, p. 75. Before we leave the subject of marriage, a word on the marital relations will not be out of place. We have often read of the momentary lending, or exchange, of wives as a token of friendship or generous hospitality. Hearne writes of the Eastern Dénés: "It is a common custom among men of this country to exchange a night's lodging with each other's wives. But this is so far from being considered as an act which is criminal, that it is esteemed by them as one of the strongest ties of friendship between two families" (*Op. cit.*, p. 129). Now we read in an old "History of Genghizcan the Great" that a law by that famous conqueror having been promulgated, which punished adultery with death, "the Inhabitants of Caindu murmured against this Law, because they had a Custom amongst them to testify their Respect and Love to their Friends by offering their Wives to them when they came to see them and regale them with their Company" (*Op. cit.*, p. 85). So inveterate was with them this custom that, in answer to several petitions, the Mongol Emperor had to rescind his edict, as far as that particular people was concerned.

As to the Yukaghirs, of whose easy morals mention has already been made, it is, even at the present day, their custom to offer the bed of a girl to any stranger to whom they may give hospitality (Jochelson, *op. cit.*, pp. 62-65). Yet these aborigines are pronounced by the same author to be, morally, much superior to the Yakuts who, he declares, "are known for their lack of modesty" (*Ibid.*, p. 67).

The same may be said of the way of naming children, or rather the parents of children, which obtains among most of the northern Dénè tribes. With them it is just the reverse of what we see amongst us; instead of a son taking the name of his father, the latter takes that of the former. For instance, a Sékanais hunter may have been known as *Nonrta*, the Lynx, before his marriage: as soon as his tent is blessed with the birth of a son, whom we will call for convenience's sake *Karh*, the Rabbit, *Nonnta* socially ceases to exist, and becomes instead *Karh-tha*, or the Rabbit's Father. The same is customary among the Babines who in the present case, will call the new paterfamilias *Kærh-pèp*.

Now here is what Waldemar Jochelson has to say in this connection of the Yukaghirs of Siberia: "The custom still survives, by which the parents, after the birth of the first child that has taken the name of some deceased relative, abandon their own names, and call themselves the father and mother of the first-born, son or daughter, so and so".[1]

Just as significant is the well-known point of American etiquette according to which one has to keep a prolonged silence when he meets a stranger before delivering himself of any message or speech that he may have in contemplation. But Wrangell thus describes the meeting of his interpreter with two Tchuktchis: "When he came up to them, they saluted him gravely, and sat down without speaking. The interpreter then filled their pipes, still without a word being spoken, and it was not until these had been smoked out that he began his discourse".[2]

Another traveller, John Ledyard, further tells us that "the Tartars here, when they smoke the pipe, give it round to every one in the company".[3]

Are not these two last distinctive customs sufficient by themselves to create the illusion that we are transported into the boundless plains or forests of North America, instead of roving in the company of the natives of the tundras and morasses of Eastern Siberia? Any reader, however so little conversant he may be with the sociology of aboriginal Americans, will grasp at once the full significance of habits which cannot in any way be put to the credit of the particular environment of the tribes among which they prevail.

There are other similar observances common to both Asia and North America which I may now forbear detailing. The foregoing will, I hope, suffice for my purpose.

[1] W. Jochelson, *op. cit.*, p. 105.
[2] *Op. cit.*, p. 347.
[3] Memoirs, p. 326.

A MAN OF THE YUKAGHIRS

XIII.

Yet should an ultra-fastidious critic wish for something of a still more exclusively psychological order, I think I am in a position to satisfy him. I am very much mistaken, indeed, if the evidence I am now going to furnish does not carry conviction to the mind of the most prejudiced reader. Indeed, I will confess that it is the little discovery of which I am now going briefly to entertain the reader which put me on the track of the real points of similarity between the aborigines of America and those of Asia, and suggested the advisability of undertaking the special investigations which have culminated in the present paper.

In 1895 I published in these very Transactions "Three Carrier Myths", the first of which, called "Pursued by their Mother's Head", relates the fate of an unfaithful woman who was slain by her husband, and whose head then went after her two little children as they were fleeing from the theatre of the tragedy.

I beg to call the reader's attention to the characteristic details of the latter's flight, and, in order to facilitate comparisons, I must be allowed to reproduce herewith the part of that legend which refers to the hegira of the two little wanderers. Here it is according to my informants of twenty years ago, such as our Institute published it at that time:

"While the two brothers were going on at random, the younger, who was packed by the other,[1] saw of a sudden their mother's head coming out after them. Then he said: 'Elder brother, mother's head is pursuing us'. Whereupon his elder brother threw out behind himself, without turning back, the stone arrow-head which his father had given him. The arrow-head became at once a mountain which, for the while, cut them off from their mother's pursuit.

"But their mother's head was changed into wind and continued to pursue them. 'Elder brother, mother's head is still after us', said the little one in the swaddling clothes. Thereupon his brother threw behind him, without looking back, the *rwæscho* thorn handed him by his father. The thorn transpierced the head and set it bleeding, after which it was transformed into a thorny bush. The bush grew to a prodigious height, and for a moment it barred the passage to their mother's head. But the head finally jumped over it and continued to pursue them.

[1] The reader should remember that the Carriers of British Columbia always carry their babes on the back, with their face turned in an opposite direction to that of the packer, and that the child is carried in an upright position.

"Therefore, the child in the moss[1] said again: 'Elder brother, mother's head is still coming after us'. Then the eldest child threw behind him the woodpecker's tail, which was instantaneously changed into fire.[2] Yet the head passed through the flames and was still after them".[3]

With the above myth, which is as literal as possible a translation of the original Indian narrative, I must now ask the reader to compare the equivalent passages of a legend in vogue among the Samoyeds of Siberia, such as I have accidentally found it in a book, "The Great Frozen Land", the author of which himself takes and translates it from a German work published in Saint-Petersburg.

I had no knowledge of either book until about six months ago.

The tale in question relates how a woman killed another woman who had two children, and when these took to flight, she set in pursuit of them. Owing, perhaps, to the inability of the original transcriber to grasp them, the Siberian lacks the interesting little details of the Carrier myth; but the two narratives are essentially the same in those very facts which are characteristic.

The flight of the two sisters is described in the following lines of the German-English book. The murderess of their mother is after them.

"She runs seven days, and then overtakes them, and will lay hold of the younger maiden, who lags behind. The elder maiden, however, throws a grindstone behind her. At once a river flows along, and steep cliffs rise on both banks of the river. The old woman remains standing on the other side of the river and the maidens escape.

"The river flows seven days and then flows away. So the old woman runs after the children again; she runs for seven days, and then overtakes the maidens. She is just going to lay hold of the younger when the elder threw a firestone (flint) behind her, and at once a high mountain rises up, and the old hag remains standing behind the mountain.

"After seven days the mountain disappears and again the old woman begins to run. She runs for seven days and then overtakes the maidens and will lay hold of the younger. The elder throws a comb behind her, and there rises a thick forest, so thick that the old woman cannot come through. But after seven days the forest vanishes, and then the old woman began again to run after them".[4]

Let us now pause and compare. In both legends a woman is killed who has two children, and, as a result of her death, the two little ones are condemned to flee, being pursued in the one case by the head of their own mother, in the other by her slayer.

[1] The Carriers use moss as swaddling clothes.

[2] The tail of that bird is red. Hence this passage is allegorical.

[3] *Op. cit.* (Trans. Can. Inst., Vol. V, pp. 5-6).

[4] F. G. Jackson, "The Great Frozen Land", pp. 210-11.

Note now the most characteristic and quite extraordinary means adopted according to both narratives to stay the progress of the pursuer: an apparently insignificant object is thrown out by the elder of the two children, which is invariably transformed into a momentarily insurmountable obstacle. Nay, even one of the means of self-protection is about identical in both Siberian and American stories: in the former a firestone, in the latter a stone arrow-point, are thrown out, both of which are changed into a mountain.

Another means of salvation is resorted to, which, though somewhat different in itself, results in the self-same obstacle. In the one version of the legend it is a thorn, in the other a comb; but in both cases the result is the same: a forest which bars the way to the pursuer.

The merest fact that in both Samoyed and Déné myths the fugitives are saved by throwing out an object, whatever it may be, which is changed into an obstacle of any kind in the way of the pursuer would of itself stamp those stories as having a common origin. No stretch of the imagination or display of scepticism will ever be equal to the task of tracing this similarity to environment or mere hazard.

This is so clear that I need not insist.

The further progress of the fleeing children is also practically the same in both narratives, as is likewise the ultimate end of their tormentor. According to the American story, the former reached a large lake, which they crossed on a dam that disappeared after them. Yet their pursuer managed to again overtake them, until it was finally swallowed up by two whales which sprang out of the water.

With the Asiatic legend, the fugitives are carried over a strait by a beaver, and their tormentor ends by being drowned through the wiles of a sturgeon, while in the act of attempting to reach them.

The numbers in both narratives are what are known to sociologists as the sacred numbers. These are generally the number four among the American Indians; with the Carriers the number two plays a similar rôle—hence the two whales of their narrative—whilst the Samoyeds replace it by the number seven, which is common to them and the Jews of old.

To return to our legend. Although I had long suspected mythological as well as sociological and technological resemblances between the natives of America and those of Palæo-Asia, I am free to confess that it was with a feeling of great satisfaction that I fell upon the above remarkable counterpart among the Samoyeds of a Déné legend I had myself published long before. Had I previously noticed a few stray, but highly significant, remarks of the reviewer of the "American Anthropologist", my surprise would not have been so great. Here are those remarks:

"Of the 122 episodes or tales (out of 139) most commonly occurring in the Koriak myths, 83 per cent. are met with in the myths of the North American Indians, 29 per cent. in those of the Eskimo, and only 18 per cent. in the traditions and tales of the Mongol-Turkic peoples of the Old World. The American element in the Koriak myths resembles in form the tales of the Athapaskans [or Dénés], in content those of the Tlingit. These resemblances, J. holds, are clearly due to close relationship of the Indians and the peoples of N.E. Siberia in past times, if not, perhaps, to some extent at least to a common origin of both".[1]

These remarks, which though published a few years ago, I had not noticed before the last few weeks, will, I believe, quite appropriately close this section of my little essay. They are from the pen of the late Dr. Chamberlain, and are based on a study of the "Asiatic and American Element in the Myths of the Koriaks"[2] by Waldemar Jochelson, of Saint-Petersburg.

[1] The American Anthropologist, Vol. VIII, p. 722.

[2] *Uber Asiatische und Amerikanische Elemente in den Mythen der Koriaken* (*Internationaler Amerikanisten-Kongress*, Stutgart, 1904; Vol. I, p. 119).

CONCLUSION.

We may therefore now take it for proven that:

1st. The passage not only of individuals, but of whole bands or tribes of aborigines, from Asia to America is more than possible: it is probable, since several persons are known to have effected it, and commercial intercourse has existed from time immemorial between the two countries.

2nd. This passage must have really been accomplished by the present North American tribes, because we find that on the Pacific side of the American continent the number of native stocks who differ radically from each other is very much greater than on the Atlantic slope, a circumstance which predicates immigration from Asia much more than from any other continent.

3rd. The very traditions of the Dénés and other North American peoples point to a northwestern origin and the crossing, in times past, of a narrow sheet of water.

4th. The geographical nomenclature of both Western and Eastern Dénés, no less than the traditions of the southern Navahoes, support the thesis of such an origin and southward migrations.

5th. Most important technological points, such as the building and use of human habitations and adjuncts thereto, fishing contrivances and the like, also tend to confirm it.

6th. The sociology of Palæo-Asiatics and that of North American peoples, especially with regard to the way of washing oneself, eating meat, preserving and cooking fish and sap, the disposal of the dead, costume and modes of personal adornment, the manner of preparing for, and practising, war, ceremonial banquets and national amusements, are identical on the adjoining parts of the two continents.

7th. Such exclusively psychological characteristics as the religious system, shamanism and the cult of spirits, totems or protecting genii, the various modes of contracting marriage and the improvisation of love-songs, as well as the etiquette of silence upon meeting with a stranger, the use of the calumet as a means of determining peace or war, and the smoking of the same pipe in succession by a crowd of people, the naming of married persons after their first-born, likewise prove, if not an absolute community of origin, at least past intercourse, between northeastern Asiatics and northwestern Americans.

8th. This same intercourse is furthermore irrefutably proved by a legend which is strikingly the same among both Samoyeds and Carriers, and the fact that many other mythological similarities do exist between northeastern Asiatics and northwestern Americans.

A LAST WORD.

I had long been aware that an expedition under the auspices of a Mr. Jesup was studying scientifically the modern aborigines of northeastern Asia, with a view to comparing them with the natives of northern America, but had never seen any mention of the results of its researches, which I am even now told are still in course of publication. However, my attention was lately called to an estimate or *résumé* of the conclusions which can legitimately be drawn from its labours and what was previously known of the question, and I feel it my duty to share this with my readers. Dr. Alexander Chamberlain, then, wrote some time ago:

"Summing up the evidence on this question, it may be said with certainty, so far as all data hitherto presented are concerned, that no satisfactory proof whatever has been put forward to induce us to believe that any single American Indian tongue or any group of tongues has been derived from any Old World form of speech now existing or known to have existed in the past.

"In whatever way the multiplicity of American Indian languages and dialects may have arisen, one can be reasonably sure that the differentiation and divergence have developed here in America, and are in no sense due to the occasional intrusion of Old World tongues individually or *en masse*. It may be said here that the American languages are younger than the American Indians, and that, while the latter may have reached the New World in very remote times *via* Bering Strait, the former show no evidence of either recent or remote Asiatic (still less European) *provenance*.

"There is absolutely no satisfactory evidence, from a linguistic standpoint, of the ultimate Asiatic derivation of the American aborigines; nor is there any of such a character as to argue seriously against such a view, which seems on the whole both reasonable and probable.

"Certain real relationships between the American Indians and the peoples of northeastern Asia, known as 'Paleo-Asiatics', have, however, been revealed as the results of the extensive investigations of the Jesup North Pacific Expedition, which have been concerned with the somatology, ethnology, mythology, folk-lore, linguistics, etc., of the peoples on both sides of the Pacific, from Columbia river to Bering Strait, and from the Amur to the extreme point of northeastern Asia".[1]

[1] "American Anthropologist", Vol. XIV, p. 55.

The writer thus ends his review: "The general conclusion to be drawn from the evidence disclosed by the Jesup Expedition is that the so-called 'Paleo-Asiatic' peoples of northeastern Asia, *i.e.* the Chukchee, Koryak, Kamchadale, Gilyak, Yukaghir, etc., really belong physically and culturally with the aborigines of northwestern America".[1]

So far, so good. We have here as explicit as possible an admission of at least past intercourse, nay almost community of origin, between the Asiatic and American aborigines—the very conclusion I have myself reached after an altogether independent investigation, and without being in the least aware of that suggested by the labours of the Jesup Expedition.

Considering the nature of the ground I operated on, I might almost be tempted to regard my own researches as even more important than those of the above mentioned American body, as far, at least, as the ethnological conclusions they warrant are concerned. The Siberian aborigines are to-day Russianized to a great extent, and for that reason the study of their life and sociological characteristics may be said to have lost much of its value in the eyes of the ethnologist.[2] But my own work was based on old, and now very rare, books by writers who saw them in their primitive state. Hence the advantage would seem to be on my side.

Be this as it may, the identity of our conclusions with regard to the ethnographical unity of the Siberians and the North Americans must be regarded as all the more significant as they were reached after quite independent researches, since practically the last line of the preceding pages was written before I had any inkling of the results of the Jesup Expedition.

It should, therefore, be perfectly useless henceforth to dispute the accuracy of those conclusions. They are now admitted by all who have made an exhaustive study of the question.

Yet the late Dr. Chamberlain and myself differ on a most important point. While conceding the identity of the above mentioned groups of human beings from an ethnological standpoint, our late lamented friend claimed that the "Palæo-Asiatics" "probably reached the parts of Asia they now inhabit (or once inhabited, for some of them had formerly a larger area of distribution) from America at a time more recent than the original peopling of the New World from Asia by way

[1] *Ibid.*, pp. 55-56.

[2] A member of the Jesup North Pacific Expedition admits as much when he writes of the Yukaghirs that they are "a tribe which to a great extent has lost its original peculiarities" and the study of which is "difficult, and, from a practical point of view, a thankless task" (W. Jochelson, "The Yukaghir and the Yukaghirized Tungus", p. 2).

of Bering Strait. Like the modern Asiatic Eskimo, they represent a reflux from America to Asia and not *vice versâ*".[1]

What made the learned doctor reach such a conclusion I entirely fail to see. This seems to me against every bit of evidence, therefore gratuitous, and some might almost say in defiance of common sense. The perusal of the foregoing pages, which were not written to antagonize such an assumption, since at the time I did not even know of it, will, I believe, have convinced any reader that it cannot be consistently entertained.

In this connection, I cannot refrain from quoting from a letter which a prominent physiologist, Dr. Ales Hrdlicka, addressed to me at a time when I thought of presenting the present essay to a scientific body he represents. Speaking of my conclusions, my learned correspondent wrote:

"I only trust that they do not relate to the plausibility of the Asiatics, or any part of them except the Eskimo, being of American origin. I have paid a good deal of attention to that question since several years, and have made, as you doubtless know, a fairly long trip through Siberia and Mongolia, the results of which all tend to sustain the theory of the Asiatic origin of the Americans, while pointing to the utter improbability of a migration at any time in the opposite direction.

"The latter peculiar notion, by the way, is a very old one; you will find it expressed quite strongly as early as 1836, in Coates (Mem. Soc. Pa., III, Part 2, page 6); but it is wholly superficial and takes no account of the fundamental and inflexible laws of human migration, namely those of movement in the direction of least resistance, or of the greatest material prospects, both of which laws point surely much more forcibly from Asia to America than the reverse"[2]

These remarks, from a scientist with whom I am not otherwise in full community of opinion and who had himself such splendid opportunities to study the subject, must be conclusive. They fully confirm my contention that the present North American Indians, or at least the Dénés, came from Eastern America, as has been fully established in the foregoing pages.

[1] *Ibid.*, p. 56. At the very latest hour I received from the same author communication of a pamphlet entitled "Remains in eastern Asia of the Race that peopled America", from which I cull one of the concluding paragraphs. "The writer", he says, "feels justified in advancing the opinion that there exist to-day over large parts of eastern Siberia, and in Mongolia, Tibet, and other regions in that part of the world, numerous remains, which now form constituent parts of more modern tribes or nations, of a more ancient population (related in origin perhaps with the latest paleolithic European), which was physically identical with, and in all probability gave rise to, the American Indian".

Whereby it will be seen that, quite independently of each other, Dr. Hrdlicka and I have reached indentical conclusions on this momentous question.

[2] Letter to the writer, Washington, D.C., June 1, 1914.

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N.B.—The following bibliography is restricted to the authors mentioned in the foregoing essay. Some of them had their works published both in England and the United States, and, in a very few instances, I may have quoted from, or referred to, such editions as I possessed before the loss by fire of my original library, instead of those I now have. One of the objects of these few pages is to record those instances, so that the reader who could not find the passage alluded to in the edition I mention in the foot-notes may be moved to try another one.

A second object I have in view in presenting the reader with this list of books is to give fuller titles and, in some cases, reveal by the dates mentioned therein the epoch of the voyages and explorations which yielded the results I have utilized in the course of the foregoing paper.

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SETTLEMENT OF INTERNATIONAL DISPUTES.

BY HON. MR. JUSTICE WILLIAM RENWICK RIDDELL.

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In the following paper I propose to show the methods adopted for the settlement of their international differences by Britain (including Canada) and the United States, that is, the English-speaking nations, from the time of the substantive Treaty of Peace, signed September 3rd, 1783.

This treaty had, by Article II, fixed the boundaries of the new Republic; one of these was with reference to the source of the Saint Croix, while another was the middle line of the Great Lakes and connecting rivers.

There were two rivers either of which might fairly be called the St. Croix, and the two nations claimed respectively that as the true St. Croix which would give it the more territory.

Again, Britain continued in possession of the forts on the left bank of the waters (Dutchman's Point, Point au Fer, Oswegatchie, Oswego, Niagara, Buffalo, Detroit, Michillimacinac). This was because some of the States had passed legislation which prevented British creditors from recovering their debts from American debtors.

The Treaty of 1783 had by Article IV expressly provided that "creditors on either side shall meet no lawful impediment to the recovery of the full value in sterling money of all *bona fide* debts heretofore contracted." Notwithstanding this, the States refused to repeal the obnoxious laws, and the state courts held that these laws were binding. Many representations were made by the United States as to Britain remaining in possession of the forts spoken of; but they were told with the utmost firmness that Britain intended to remain in possession of the territory until redress should be granted to British subjects.

Some three thousand negro slaves had, during the Revolutionary War, come into the British lines relying on proclamations which offered freedom, and they accompanied the British forces on evacuation. The Treaty of 1783 by Article VII had provided that the British troops should not carry "away any negroes or other property of the American inhabitants." The United States demanded the return of the 3,000 negroes or payment for them. Britain replied: "The negroes became free when they came within British lines and were no longer property of the American inhabitants"; and refused either to give back the slaves or to pay for them.

In the terrible war which Britain carried on with France arising out of the French Revolution, she found it necessary to starve France out if possible; accordingly Orders-in-Council were passed to stop all vessels carrying food to France. Other restrictive orders were made, and as the British navy was immensely superior to any which could be brought against it, nearly all importation to France was stopped. Many American vessels suffered—indeed it was the American mercantile fleet which contributed most of the victims. The United States claimed the illegality in international law of these regulations. Britain answered—"Necessity".

Feeling ran high in the United States, and measures were threatened in congress which would inevitably have resulted in war—and for war the United States could not be more unprepared. The ordinary means of negotiation having failed, Washington (April 16th, 1794) sent John Jay, Chief Justice of the Supreme Court, as envoy extraordinary, to negotiate a treaty with Britain if possible.

He succeeded, November 19th, 1794, in obtaining a Treaty, no doubt as favourable as could be had, but not containing everything which had been hoped for.

Britain absolutely refused to give any compensation for the negroes —and of this Washington made particular complaint. She refused all compensation for retaining the forts, saying that this was due to the fault of the United States. But the United States agreeing to pay the debts that British subjects had been prevented from recovering, Britain agreed to give up the retained territory by June 12th, 1796. Britain also agreed to pay American subjects for ships, etc., illegally taken. By this Treaty, which is the beginning of modern international arbitration, three matters were left to arbitration.

1. What is the River St. Croix? This by Article V was to be left to commissioners, one to be appointed by His Majesty, one by the President, and they to agree upon a third; if they were not able to agree, each was to propose one person, and one of these should be drawn by lot.

Britain named Thomas Barclay of Annapolis, a pupil of Jay's, who, born in New York State, had fought on the Loyalist side during the Revolution and attained the rank of colonel. He afterwards practised law in Nova Scotia, and became a member and Speaker of the Legislative Assembly. He was also for a time British Consul at New York.

The American Commissioner was David Howell, a Judge of the Supreme Court of Rhode Island; he suggested as the third Commissioner Egbert Benson, formerly Judge of the Supreme Court of New York, and afterwards a Judge of the Circuit Court of the United States. Colonel Barclay accepted Mr. Benson as a "cool, sensible and dispassionate third Commissioner"—no bad recommendation.

The three made a unanimous award at Providence, Rhode Island, in 1798, fixing the Schoodiac as the true river St. Croix, thus giving effect to the British claim, the United States having put forward the Magaguadavic.

2. The amount the United States should pay for debts which British creditors were prevented from recovering, was by Article VI to be determined by five commissioners, two appointed by His Majesty, two by the President, and the fifth by the unanimous vote of these four; if they could not agree, the two commissioners on one side were to propose one person, the two on the other side another person, and of these two so proposed, one should be chosen by lot.

The British representatives were Thomas Macdonald and Henry Pye Rich; the American, Thomas Fitzsimons and James Innes. They could not agree on the fifth, and accordingly a lot was taken resulting in the selection of John Guillemard, of London, the nominee of the British commissioners. Colonel Innes, dying, was succeeded by Samuel Sitgreaves. The Board seems to have been at loggerheads from the beginning; faults of temper showed themselves, the reference was a failure and the Board dissolved.

The Governments, finally, in 1802, entered into a Convention whereby £600,000 was to be paid by the United States in full.

3. The amount due to American citizens for illegal seizures, etc., was by Article VII left to a Board of five commissioners selected in the same way. The British commissioners were Drs. John Nichol and John Anstey; one of the American was Christopher Gore, the preceptor of Daniel Webster, and at the time United States attorney for Massachusetts. He was afterwards Governor of Massachusetts and a member of the Senate of the United States. The other was William Pinkney, who had been a member of the Maryland Legislature and who afterwards became Minister to London, and Attorney-General of the United States. He was a man of great ability and sound judgment. These chose by lot Colonel John Trumbull the painter, as fifth Commissioner.

Dr. Nichol retired from the Board in November 1798, when he was knighted and became King's Advocate. Twenty-five years later he became judge of the High Court of Admiralty, having been in the meantime Dean of Arches and Judge of the Prerogative Court of Canterbury. He was succeeded on the Board by Dr. Maurice Swabey, also of Doctors' Commons.

Much delay took place in this arbitration, due chiefly to the trouble in that under Article VI; but when that was out of the way, the arbitrators speedily agreed, finishing their labours February, 1804. A sum of £2,330,000 or $11,650,000 was paid by Britain on this head.

Jay's Treaty was received in the United States with execration by the party which was favourable to France and which was powerful in the House of Representatives. Jay was charged with selling his country, and was even burned in effigy. Rochefoucault, who travelled through the United States at the time, speaks of the hatred against Britain of the Americans and their confidence that the President (Washington) would not be hoodwinked into approving the Treaty. Washington waited long before ratifying the Treaty, and when at length he did so, after a secret vote by the Senate, he lost much of his popularity and was joined with Jay in the curses of a whole political party. This extraordinary outbreak of popular malevolence prevented Jay from obtaining the prize upon which he had set his heart—the Presidency. But time brings about its revenges; the Treaty which made him the best hated man of his time is now his highest title to immortality. It should be added that notwithstanding the feeling against it when it was negotiated, there was never any popular complaint against the results of the arbitrations provided for in the Treaty.

The war between France and Britain continued to do its evil work indirectly as well as directly. Britain was compelled to rely upon her navy for her very existence, and she could not get enough sailors to man it voluntarily. It is a part of the common law of England, as of all civilised countries, that his country has a right to call upon every man to defend it. It was, and is, law that every British subject may in case of need be forced into the navy as a sailor; hence the press gang with all its horrors. Again, by the common law of England—and by Magna Charta—no man may put off his allegiance. Many British subjects had joined American ships and some of these were become American citizens. Britain claimed the right of seizing these whenever she found them. The United States admitted that she might take them if she found them in her own waters; Britain admitted that she had no right to take them in American waters; the dispute was as to the high seas. Britain said: "The high seas are no man's land, therefore I violate no other nation's territory by seizing my subjects off American ships there". The United States said: "No man's land, and therefore my flag makes it mine for the time being." Britain had the power and she continually seized her subjects, former and present, on American ships on the high seas.

Probably this would not have been so much objected to; but the British commanders went further. They impressed hundreds of American citizens, claiming them to be British. Sometimes, perhaps, this was by mistake, it is too much to think it was always so. The captains had to have men, and they themselves were only men, and men to whom the salvation of their country was paramount to every other consideration.

This was a constant source of irritation and of negotiation wholly fruitless. Britain was in death grips with Napoleon and must have men.

Then in her war with France she closed the continent to all trade, (including the American) by Orders-in-Council, ruining American commerce.

The Americans—or some of them—believed, or pretended to believe, that Britain was stirring up the Indians on the West and North-West frontier, and the west was embittered against her accordingly. No one now believes that Britain was guilty of any such conduct. The enmity of the Indians was due to two causes: the one, inevitable, arising out of the advance to the West and North-West of settlement, the other which might have been, and by the British was avoided, that is the treatment of the Indians as inferior creatures unworthy of consideration or decent treatment; in short, treating them on the brutal principle laid down by one of the most celebrated of American generals—"The only good Indian is a dead Indian."

Canada was a tempting morsal, and, as it was thought, could be taken without difficulty. Which of these considerations were the real cause of the war declared in 1812 I do not stop to discuss; they were all talked of.

The war lasted two years and a half and decided nothing; the parties agreeing to the *status quo ante bellum*. Some American writers claim that impressment of American sailors was put an end to by the war. This is absolutely without basis in fact.

But the Treaty of Ghent, December 24th, 1814, furnishes other instances of arbitration.

4. From the time of the Treaty of Peace there was a dispute as to the Islands Moose, Dudley and Frederick in Passamaquoddy Bay. Negotiations went on for some time, and during the war of 1812 the British took possession of Moose Island. By Article IV of the Treaty of Ghent, it was left to two commissioners, one appointed by the King and one by the President, to determine the ownership of all the Islands in Passamaquoddy Bay.

The British commissioner was Colonel Thomas Barclay, whom we have already met; the American was John Holmes, afterwards a member of Congress and a Senator. They made an award, New York, November 24 th, 1817, giving the three named islands to the United States, and all the others to Great Britain, and add: "In making this decision it became necessary that each of the commissioners should yield a part of his individual opinion."

5. In the Treaty of Peace, 1783, the boundaries of the United States were thus laid down: "From the northwest angle of Nova Scotia, viz., that angle which is formed by a line drawn due north from the source

of Saint Croix River to the Highlands; along the said Highlands which divide those rivers which empty themselves into the River St. Lawrence from those which fall into the Atlantic Ocean to the north-westernmost head of Connecticut River." We have seen that the "Saint Croix River" was identified by arbitration in 1798; but what were "the Highlands" remained a matter of dispute. In 1803 a commission to settle was agreed upon by Lord Hawkesbury (afterwards the first Earl of Liverpool) and Rufus King, the American Minister; but this failed of ratification in the Senate. In the negotiations at Ghent, the British Commissioners endeavoured to have the line revised; but this was not acceded to by the American Commissioners. It was agreed by Article V of the Treaty to leave this dispute to two Commissioners, appointed by the King and the President respectively. If the Commissioners could not agree they were to report to their Governments and the matter was to be referred "to some friendly sovereign or State". Colonel Thomas Barclay was again appointed by Britain; the American Commissioner was Cornelius P. Van Ness, subsequently Chief Justice and Governor of Vermont. They were unable to agree and so reported. We shall find the "Northeastern Boundary" cropping up more than once.

6. Another of the boundaries mentioned in the Treaty of Peace was thus stated: "Along the middle of said River (Iroquois or Cataraquy) into Lake Ontario, through the middle of said Lake until it strikes the communication by water between that lake and Lake Erie, thence along the said communication into Lake Erie, through the middle of said lake until it arrives at the water communication between that lake and Lake Huron, thence, etc." Disputes arose as to the ownership of certain islands and as to what was the middle of the several lakes and rivers; and this matter was left, by Article VI, to two Commissioners, one appointed by each side. The British representative was at first John Ogilvy, of Montreal; he died at Amherstburgh in 1819 from fever caught in the discharge of his duties, and was succeeded by Anthony Barclay, son of Colonel Thomas Barclay, already mentioned. The American Commissioner was General Peter Buel Porter who had made a good record as a soldier during the war of 1812, and was to be Secretary for War in Adams' Cabinet. They made an award at Utica, June 18th, 1822, which gave universal satisfaction.

7. The Treaty of Ghent by Article I had provided that "all territory, places and possessions whatsoever taken by either party from the other . . . shall be restored . . . without . . . carrying away of . . . any slaves or other private property." During the war many slaves had entered the British lines, most of them induced so to do by a Proclamation of Admiral Cochrane which in effect promised their freedom. The United States claimed the return of these slaves; Britain refused saying

that they were not slaves but free men. Much negotiation took place, and at length, October 18th, 1818, was signed a convention between the two countries, which by Article V provided that the question whether the United States were entitled to restitution of, or a full compensation for these slaves should be left to some friendly sovereign or State, The Emperor of Russia was selected, and he, April 22nd, 1822, made an award in favour of the contention of the United States.

8. Upon the award being communicated to the parties, they at once entered (July 12th, 1822) into a convention for carrying it into effect.

It was agreed, Article II, first to determine the average value of the slaves to be paid for. Each government was to appoint a Commissioner and an Arbitrator, and these four were to sit as a Board. If the Board or a majority could not agree, "recourse shall be had to the arbitration of the Minister or other agent" of Russia at Washington.

The British Commissioner was George (afterwards Sir George) Jackson, a diplomat of great experience; the arbitrator was John McTavish. The American Commissioner was Langdon Cheves, who had been a member of Congress, Speaker of the House and a Judge of the Supreme Court of South Carolina; the arbitrator was Henry Seawell, a Judge of the Superior Court of North Carolina. These four made a unanimous award, September 11th, 1824.

9. Article III of the Convention of 1822 provided that when the average value of the slaves had been determined, the two Commissioners should determine the number to be paid for. If they should not agree; they were to choose by lot one of the arbitrators. They failed to agree; and the Governments got tired of the delay and settled by Britain paying $1,204,960 in full satisfaction (under a Convention November 13th, 1826.)

10. We have seen that the Treaty of Ghent provided by Article V that if the Commissioners should not agree as to the northeastern boundary, "some friendly sovereign or State" should be appealed to. We have also seen that the Commissioners did not agree. A Convention was entered into, September 29th, 1827, under which William, King of the Netherlands, was chosen arbitrator. January 10th, 1831, he made an award; the American Minister promptly protested against it, and the British Government did not insist. The line was afterwards settled by diplomatic negotiation by Ashburton and Webster, and is set out in the Ashburton Treaty of August 9th, 1842.

11. After the Treaty of Ghent, many claims were made against Britain by American citizens and many by British subjects against the United States. On the part of the United States were such claims as the wrongful seizure of vessels as slavers or for fishing in British waters,

seizure by British men-of-war after Treaty of Peace signed; duties wrongfully exacted, etc. On the part of Britain, seizure of vessel before war declared, arrest of British subjects, detention of vessels and other property, duties inproperly exacted, dishonoured bonds of Florida and Texas, etc. These were agreed by Article I of a Convention entered into February 8th, 1853, to be left to the decision of Commissioners, one appointed by each Government, they to choose a third person to act as Arbitrator or Umpire. If they should not be able to agree, they were each to name one person and then select one of those named by lot.

The British Commissioner was Edmund Hornby, a barrister, afterwards Sir Edmund Hornby, Judge of the Consular Court at Constantinople and later Judge of the Supreme Court of China and Japan. The American was Nathaniel G. Upham, for some years a Judge of the Supreme Court of New Hampshire. They agreed on Martin Van Buren, former President of the United States, as Umpire, but he declined to act, and they selected Joshua Bates, an American by birth and allegiance, but carrying on business in London, as partner in the firm of Baring Bros., & Co.

They disposed of a great many cases, sometimes the two Commissioners agreeing and sometimes Mr. Bates being called upon. The awards against Britain totalled about $330,000, against the United States $275,000.

12. After the war of 1812, the question arose whether the United States had not forfeited by that war all right to fish within British territory. October 20th, 1818, the parties entered into a convention whereby the United States renounced all right to fish within three miles of British land except the Magdalen Islands, the coast of Labrador and a named part of Newfoundland. By Article I of the Reciprocity Treaty of June 5th, 1854, it was agreed that so long as the Treaty should last, the Americans should have the rights (or "liberties") given up by the Convention of 1818; but to prevent any dispute as to the placcs t which they should have the right to fish, a Commission was agreea to be formed. Each Government was to appoint a Commissioner, add they to choose an Arbitrator or Umpire; if they could not agree eachnwas to name one person and one of these to be selected by lot.

Britain appointed M. H. Perley, of New Brunswick, the United States G. G. Cushman, of Maine; and the Hon. John Hamilton Gray of New Brunswick was selected Umpire by lot.

Mr. Cushman resigned pending the reference, and Benjamin Wiggin succeeded him; he, too, resigned and was followed by John Hubbard, and he by E. L. Hamlin. On Mr. Perley's death, the well-known Joseph Howe, of Nova Scotia, succeeded him. Very many rivers, streams, etc., came on for decision; there was much dissatisfaction on the part of the

United States with the Umpire, Mr. Gray, going so far as to suggest his removal on the ground of flagrant partiality; but on the whole the reference was successful.

13. There was for many years a dispute as to the boundary between the two nations toward the west. By the Convention of 1818, it was agreed that the 49th parallel should be the boundary from the Lake of the Woods to the Rocky Mountains. Britain west of the Rocky Mountains claimed down to the mouth of the Columbia between 46° and 47°; the United States as far north as 54° 40′. By Article III of the Convention, it was agreed that west of the Rockies the disputed territory should, for ten years, be open to the vessels, citizens and subjects of either power without prejudice to the rights of each. In 1823 and 1826, attempts were made to settle the line, and the Convention of August 6th, 1827, indefinitely extended the period for common use; finally in 1846, Pakenham, the British Minister, accepted the offer made more than once, and the line of 49° was agreed upon. This was after Polk's election had been fought on the battle cry "Fifty-four forty or fight"; and war had been thought inevitable. The Treaty was concluded June 15th, 1846. By Article IV it was provided that the farms, etc., of the Puget Sound Agricultural Company to the north of the Columbia River should be confirmed to the Company, but that the United States might take them at a proper valuation. Article III provided that "the possessory rights of the Hudson Bay Company and of any British subjects . . . should be respected." These rights were not respected, and negotiations failed to fix the amount which should be paid. A Treaty was at length concluded, July 1, 1863, whereby these claims should be referred to two Commissioners (appointed by the Governments concerned), who should choose an Arbitrator or Umpire; if they could not agree the King of Italy was to appoint. The Commissioners were Alexander S. Johnson and Sir John Rose, the well-known Canadian financier and statesman. They selected as Umpire, Benjamin R. Curtis, who had been a Judge of the Supreme Court of the United States, and who gave the magnificent dissenting judgment in the Dred Scott Case; he was afterwards to be of Counsel for Andrew Johnson on his impeachment. September 10th, 1869, the Commissioners agreed upon an award without calling upon the Umpire, giving $450,000 to the Hudson's Bay Company and $200,000 to the Puget Sound Agricultural Company.

A very important treaty commonly called the Treaty of Washington was concluded May 8th, 1871, by which four matters in dispute were referred to arbitration.

14. The first of these was the "Alabama Claims": the United States claimed for the damage due directly and indirectly to Confederate cruisers built or equipped in British waters during the Civil War, chiefly

the Alabama, Florida, Georgia and Shenadoah. This was by Article I of the Treaty referred to five arbitrators, one to be appointed by the Queen, one by the President, and one by each of the potentates, the King of Italy, the President of Switzerland and the Emperor of Brazil. The English Commissioner was Sir Alexander J. E. Cockburn, Lord Chief Justice of England, the American, Charles Francis Adams, son of President John Quincy Adams, born in Boston, a student of Daniel Webster, called to the Bar but never having practised, a member of the State Legislature and afterwards of Congress, and Minister at the Court of St. James. The King of Italy appointed Count Frederic Sclopis, a distinguished judge, who became President of the Commission; the President of Switzerland, M. Jacques Staempfli, an advocate, who had been thrice President of the Swiss Confederation; and the Emperor of Brazil, Baron (afterwards Viscount) d'Itajubâ, who had been a professor in the *faculty of law of Olinda.*

This Board met at Geneva, and, Cockburn dissenting, rendered an award, September 14th, 1872, allowing the United States the sum of $15,500,000 as indemnity. The award met some criticism in England, but the amount was promptly paid.

15. There were claims distinct from the Alabama claims. A number of Confederate raiders had left Montreal and plundered the town of St. Alban's, Vermont; some daring Confederates had attacked American steamers on Lake Erie; vessels had been detained at Calcutta because laden with saltpetre, etc. On the other hand, there were British claims against the United States—detention of vessels, destruction of property or its appropriation by the United States, unlawful arrest, etc.

These were, by Article XII of the Treaty, referred to three Commissioners, one to be appointed by each Government, and the third by the Governments jointly; if they could not agree, then by the Spanish *Minister at Washington.*

The British Commissioner was Russell Gurney, Recorder of London and Judge of the Sheriff's Court; the American, James Somerville Frazer, formerly a Judge of the Supreme Court of Indiana; and the third, named by the Queen and President conjointly, Count Louis Corti, Italian Minister at Washington.

They disallowed all the American claims, and, September 25th, 1873, made a final award of $1,929,819 in favour of Britain.

16. The next reference was of great importance. By the Convention of 1818, the United States had renounced the right to fish within three marine miles of British land, with certain exceptions. By the Reciprocity Treaty of 1854 they were given further rights so long as that Treaty should be in force; the Treaty was abrogated in 1866 and the United States were accordingly relegated to their position under the

Convention of 1818. The Treaty of Washington by Article XVIII restored these rights, but as they were claimed to be more valuable than certain rights given to British subjects by Articles XIX and XX, a Board of Commissioners was provided by Article XXII to determine the amount to be paid by the United States. This was to be composed (Article XXIII) of three Commissioners appointed, one by each party and one by them jointly.

Sir Alexander Tulloch Galt was appointed British Commissioner; John H. Clifford, the American, and on his death, Ensign Kellogg. M. Maurice Delfosse, the Belgian Ambassador at Washington, was appointed by the Queen and the President jointly. They met at Halifax, and, Mr. Kellogg dissenting, made an award November 23rd, 1877, of $5,500,000 in favour of Britain. The result was a surprise to the United States; and there was some talk of repudiation, but the amount was paid within the year allowed by the Treaty.

17. The fourth matter in dispute agreed by the Treaty to be disposed of by arbitration has a rather curious history. By the Pakenham-Buchanan Treaty of 1846 the boundary was "the forty-ninth parallel of north latitude to the middle of the channel which separates the continent from Vancouver Island, and thence southerly through the middle of the said channel and of Fuca's Straits to the Pacific Ocean." With a not unusual irony of geography there turned out to be three channels, any of which might fairly be called "the channel": Rosario (or Vancouver's) Douglas and De Haro, in the order from east to west. Britain claimed Rosario, the United States, De Haro as "the channel", and much negotiation was the result. In 1869 a Convention was entered into to refer the dispute to the President of Switzerland; but this failed to pass the Senate. British subjects entered and settled on San Juan, one of the disputed islands. General Harney landed an armed force and took possession of it for the United States. Britain ordered out men-of-war to the spot; it was, however, agreed that the two nations should occupy the disputed territory jointly until the ownership should be decided.

By Article XXXIV of the Treaty of Washington, the question was left to the decision of the Emperor of Germany. That monarch, October 21st, 1872, decided in favour of the American contention.

18. Russia had, before the cession of Alaska, attempted to exercise rights of ownership in the Behring Sea which were protested against by both Britain and the United States. Not long after the cession, in 1867, of Alaska, legislation was passed by the United States which was interpreted as preventing the killing of fur seals in Behring's Sea. A little later the United States openly claimed the sea as its own, a *mare clausum*, although it is "a sea larger than the Mediterranean and the

gateway . . . 450 miles wide." As early as 1886, Canadian sealers were seized by American cruisers and their crews detained, some imprisoned and some turned adrift in San Francisco. As the place of seizure was sixty miles from land in the open sea, this was intolerable, and immediate and vigorous protest was made.

At length, after much negotiation and a renewal of seizures in 1889, it was agreed by Article I of a Treaty signed February 29th, 1892, that the questions which had arisen "concerning the jurisdictional rights of the United States in the waters of Behring's Sea" should be referred to a tribunal of seven Arbitrators, two to be appointed by each party, one each by the President of France, the King of Italy and the King of Sweden and Norway.

The British Arbitrators were Lord Hannen, Lord of Appeal in Ordinary and Sir John S. D. Thompson, Minister of Justice of the Dominion of Canada (he became Prime Minister pending the reference). The American Arbitrators were John M. Harlan, Justice of the Supreme Court of the United States and Senator John T. Morgan of Alabama, afterwards commissioned to frame a code for the Hawaiian Islands. The President of France appointed Baron Alphonse de Courcel, a senator of France, who became president of the Board; the King of Italy, the Marquis Emilio Visconti Venosta, a Senator of Italy; and the King of Sweden and Norway, Mr. Gregers Gram, a Minister of State.

These seven met at Paris in 1893, and, August 15th, 1893, made an award substantially in favour of the British contention. It is of interest to Canadians to note that Sir Charles Hibbert Tupper was agent, and our own Christopher Robinson one of the Counsel on the British side.

19. The amount of damages to be paid Canadians, etc., for wrongful seizure was not determined by this Board; but a Convention signed February 8th, 1896, left this to be determined by Commissioners. Each nation was to appoint one; and any case in which these two were unable to agree was to be left to an Umpire appointed by the Government jointly, or if they could not agree by the President of the Swiss Confederation.

The Commissioners appointed were George Edwin King, Justice of the Supreme Court of Canada, and William L. Putnam, a Judge of the United States Court of Appeals. They agreed on an award, December 17th, 1897, of $473,151.26, which sum was paid forthwith by the United States. It was not necessary to appoint an Umpire.

20. The boundary between the United States and British territory by this time was well settled, except at Alaska—there, there was much uncertainty and difficulty. July 22nd, 1892, was concluded a convention for joint surveys of the line; but surveyors cannot decide matters of this kind. On January 24th, 1903, a convention was entered into for

the submission of the matter to "six impartial jurists of repute." Britain appointed Lord Alverstone, Lord Chief Justice of England; Sir Louis A. Jetté, Lieutenant-Governor of Quebec (formerly Chief Justice in that Province), and John Douglas Armour, Justice of the Supreme Court of Canada (previously Chief Justice of Ontario). Mr. Armour dying, Allen Bristol Aylesworth, K.C. (afterwards Sir Allen Aylesworth, Minister of Justice of the Dominion) was appointed in his stead. Elihu Root, Senator Henry Cabot Lodge of Massachusetts, and Senator George Turner of Washington were appointed on the other side. They met in London in 1903, and on the 20th October of that year made an award (the Canadian representatives dissenting, but Lord Alverstone joining in the award.)

This award created much dissatisfaction in Canada; few believed that Alverstone's action was judicial, most thought he acted as he did against his judgment, but diplomatically, so that there might be an award made. But Canadians resented still more—and chiefly—the constitution of the Board. Promised impartial jurists of repute, it was thought that two of the American Commissioners had expressed themselves in advance of their appointment in no uncertain terms upon the merits of the controversy—of one this was certainly true. This was not thought the "square deal" on the part of its most prominent and strenuous advocate.* The award, however, was submitted to without hesitation.

21. The Treaty of 1818, giving privileges to American citizens in respect of fishing in the Atlantic waters, drying and curing fish, etc., was not very definite; and constant friction showed itself between the two peoples. After many fruitless attempts at settlement, an agreement was entered into at London, April 4th, 1908, to refer the whole matter to a

* Hon. John W. Foster, once Secretary of State at Washington, who was the agent of the United States on this occasion, has the following in his "Diplomatic Memoirs" (1910) Vol. II, pp. 197, 198: "The Canadian Government complained to the British Colonial Office that the members nominated by the President of the United States were not such persons as were contemplated by the Treaty, to wit, 'impartial jurists of repute'; but the British Government did not regard this complaint of such a serious character as to bring it to the attention of the President. It was alleged that one of the American members had expressed himself publicly, some time previous to his appointment, as strongly convinced of the justice of the claim of his Government. It was also objected that no one of the three was taken from judicial life, and that they all might be considered as political rather than legal representatives of their country. The editor of Hall's 'International Law' (ed. 1904) refers to the selection of the American members as a 'serious blot on the proceedings'". Mr. Foster does not deny the charges made by the Canadian Government, nor does he attempt to justify or excuse the appointments, contenting himself with saying: "Whatever appropriateness there may have been in the objections urged by Canada, the sequel showed that the selection of the President was judicious"; adding a eulogy on the capacity and conduct of the American appointees. It is not without interest to note that Mr. Foster says nothing of the appointment of Mr. Justice Armour as a British representative.

I have never heard the conduct of President Roosevelt in this matter justified by an American; it has been explained (I cannot say how truly) by the alleged fact that it was only on the understanding that such appointments should be made that the Senate's approval of the Treaty could be obtained.

tribunal of arbitration chosen from the general list of members of the Permanent Court at the Hague, Article V. There were chosen George Gray, of the Circuit Court of Appeals; Sir Charles Fitzpatrick, Chief Justice of Canada; Dr. H. Lammasch, of the University of Vienna and an Aulic Councillor, Jonkheer A. F. De Savornin Lohman, of the Netherlands, and Dr. Luis Maria Drago of the Argentine Republic. They met at the Hague in 1910 and made an award unanimous in all respects (except that Dr. Drago dissented on one point.)

The award gave complete satisfaction to both parties, so much so that each nation claimed a victory. The fact is that both were weary of the strife over the fisheries which had been going on for over a century, and any settlement with a semblance of fairness would have been acceptable. It should be remembered, too, that most of the international hatred and contempt of some section of either nation for the other had in great measure died out.

There is another arbitration which was in fact, though not in form, between the two English speaking peoples, and has a claim to be mentioned here.

In 1814 Britain acquired from the Netherlands the Province of Demerara, Essequibo and Berbice (British Guiana), and almost at once got into a dispute with Venezuela as to the boundary between the countries. Venezuela finally claimed to the Essequibo River, though she had previously insisted on a more favourable line. In 1840 Britain directed Sir Robert Schomburgk to lay out the boundaries, which he did, taking in a large area claimed by Venezuela. Much controversy ensued. Schomburgk's monuments were taken up by Britain, but in 1886 she returned to her claim of the line of 1840. More controversy took place, and in 1894 Venezuela took possession of the disputed territory by an armed force. Next year British police removed the Venezuelan flag and were arrested but subsequently released. Then the United States interfered and the celebrated Cleveland Message was sent, December 17th, 1895.

22. In the event, a Treaty was entered into, February 2nd, 1897, between Great Britain and Venezuela to leave the dispute to four Commissioners named in the Treaty, and a fifth to be selected by these four, and if they disagreed, by the King of Sweden and Norway, the fifth to be President of the tribunal. The British Commissioners were Lord Herschell, shortly before Lord Chancellor; and Sir Richard Henn Collins, then a Justice of the Supreme Court of Judicature and to be Master of the Rolls. The Venezuelan, Chief Justice Fuller and Associate Justice Brewer, of the Supreme Court of the United States. They chose M. de Martens of St. Petersburg, a distinguished Russian jurist, professor of International Law in the University of St. Petersburg, and an eminent legal writer, as the fifth.

An award was made October 3rd, 1899, which gave Britain practically what she claimed—in some respects more.

There was considerable anger expressed in Venezuela, but it met no echo in the United States. Perhaps the fact that the notorious Castro began his obnoxious career about the same time had something to do with this complaisance; but it is probable that the Spanish war (which began 1898) and the good-will then manifested towards the United States by the Mother Country had more.

There is still another settlement of a dispute which should be mentioned—a dispute not international but interprovincial.

By the British North America Act (1867), the Province of Ontario was given the same limits as the former Province of Upper Canada. In 1870, by the Dominion Act, 33 Vic., c. 3, the Province of Manitoba was formed with its eastern boundary at the meridian of 96° W.L. At once there was a movement in Ontario, the Government of that province claiming that it went further West than 96° W.L., although this had long been considered in fact about her western limit. Many communications passed between the Governments, but without result. Then in 1876 an Act was passed (39 Vict., c., 21), extending the limits of Manitoba to the "westerly boundary of Ontario". The Dominion and Manitoba claimed that the westerly boundary was about six miles east of Port Arthur. Armed forces of the Provinces of Manitoba and Ontario took possession of Port Arthur, but the scandal was abated by an agreement to arbitrate, December 18th, 1883, by the Dominion and Province. Ontario named William Buell Richards, Chief Justice of the Province, and when he became Chief Justice of Canada, his successor Robert A. Harrison; the Dominion, Sir Francis Hincks, and the two Governments jointly Sir Edward Thornton the British Ambassador at Washington.

These Arbitrators made, August 3rd, 1878, a unanimous award in favour of the Ontario contention, which by this time was in reality limited to the generally recognised boundary. This was at once accepted by Ontario, but the Dominion refused to ratify the award. At length, in 1883, the two Provinces concerned agreed to submit to the Judicial Committee of the Privy Council three questions: (1) whether the award was binding; (2) if not, what was the true boundary, and (3) what legislation was necessary to make the decision effectual.

The Judicial Committee, August 11th, 1884, decided (1) in the absence of Dominion legislation the award was not binding, (2) the award laid down the boundary correctly, and (3) Imperial legislation was desirable (without saying it was necessary).

The Imperial Act (1889), 52 and 53 Vic., c., 28, carried the decision into effect, and ended the controversy.

Thus far particular treaties, conventions and agreements for settlement of disputes have been spoken of; it will not be without interest to say something about the general agreements between Britain and Canada on the one hand, and the United States on the other. I quote from an article written by me in the Yale Law Journal, June 1913:

"In 1908, April 4th, a general Treaty of Arbitration between the United States and Great Britain was signed at Washington. This provided (Article I) that differences which might arise of a legal nature or relating to the interpretation of treaties existing between the two contracting parties, and which could not be settled by diplomacy, should be referred to the permanent Court of Arbitration established at the Hague by the convention of July 29th, 1899, provided they did not affect the vital interests, the independence, or the honour of the two con'tracting States, and did not concern the interests of third parties.

'Article II provides that in each individual case the parties were to conclude a special agreement defining the matter in dispute, the scope of the powers of the arbitrators and the times to be set for the several stages of the procedure.

"A provision of very great significance to a Canadian appears in the Treaty. The British Government reserved the right before concluding a special agreement in any matter affecting the interests of a self-governing Dominion of the British Empire to obtain the concurrence therein of the Government of that Dominion.

"This was not, indeed, the first time the concurrence of the colony had been provided for; in the Treaty of Washington (1871) it was provided that certain parts of the Treaty were not to come into force until legislation had been passed by the colonies concerned."

It was under this general Treaty that the Hague arbitration (21 above) was held.

This Treaty, it will be seen, applies to the whole British Empire: but there is another international arrangement which (as I said in an address at Washington some years ago) "may be called a miniature Hague tribunal of our own just for us English speaking nations of the Continent of North America."

This "Treaty of 1909 was preceded by the constitution of a board of commissioners. The board was formed at the request of the President, acting under the authority of the River and Harbour Act approved June 13, 1902. The functions of the proposed board were defined in the Act, and were substantially a full investigation of the question of the boundary waters; the board was to consist of six members, three appointed by the United States and three by Canada. The President, July 15, 1902, communicated through the American Ambassador at London with the British Government, that Government transmitted

the invitation to the Government at Ottawa, the Canadian Government accepted the invitation, and this acceptance was communicated to the American Government. The American part of the board was appointed in 1903, and the Canadian in 1903 and 1905; and work was begun with all convenient speed on the Sault Ste. Marie Channel, the Chicago Canal, the Minnesota Canal, etc. This board has done an immense amount of very valuable work already.

The Treaty of 1909 was really at the instance of that Board."

Signed January 11, 1909, this "Waterways Treaty" provides "for the establishment and maintenance of an International Joint Commission of the United States and Canada—three appointed by each Government —which Commission should (Article VIII) have jurisdiction over and pass upon all cases involving the use, obstruction or diversion of the waters between the United States and Canada. But Article IX contains an agreement that all matters of difference between the countries involving the rights, obligations or interests of either in relation to the other or to the inhabitants of the other along the frontier shall be referred to this Commission for inquiry and report. Article X provides that any questions or matters of difference involving the rights, obligations or interests of the United States or of Canada, either in relation to each other or to their respective inhabitants, may be referred for decision to this International Joint Commission. If the Commission be equally divided, an Umpire is to be chosen in the manner provided by Act 45 of the Hague Convention of October 18, 1907."

It will be seen that "every dispute involving the rights, obligations or interests of the United States or of the Dominion of Canada either in relation to each other or to their respective inhabitants" may be referred to the Commission by the consent of the two countries.

"It is hard to see how a more comprehensive clause could be framed; and if the Treaty had provided that such dispute 'shall' be referred, the work would be perfect. As it is, the Dominion must give consent through the Dominion Cabinet. That is an easy task. We have a Government which is united—it must be united or it could not stand—and which in this instance does not need to go to Parliament for authority."

It is not always the case that a Canadian Parliament will consent to an international agreement made by the Government; then the Government must take the opinion of the electorate (a recent example will occur to everybody), but in this instance the Government may act without the consent of Parliament.

"But in the United States the action must be by and with the advice and consent of the Senate; and sometimes, as it is well known, trouble arises in the Senate about confirming treaties.

Each reference to the Commission will or may be but equivalent to making a new treaty. Had the provision been that the consent might

be given by the President of the United States, the position of all the parties on the two sides would have been much alike.

Better even than this would be a provision making the arbitration of the Commission apply automatically. If such a provision proved unsatisfactory, the treaty could be denounced and a new treaty negotiated. But I suppose there may be some jealousy on the part of the Senate, or perhaps the Constitution prevents. And we Canadians notice that the Constitution of the United States prevents a great many things being done over which we should have no trouble at all."

The Rush-Bagot Convention of 1817 cannot fairly be called an agreement of the kind we have been considering—it was designed to prevent troubles arising, not to settle them after they had arisen. It may be well, however, to say a word about it here:

"During the war of 1812, much damage had been done by armed vessels upon the Great Lakes. The Treaty of Ghent did not provide that such armed forces should not be kept up; but it became apparent to both sides that it would be well strictly to limit the number and quality of armed vessels upon the fresh waters between the two countries. After some negotiation notes were interchanged, April 28th and 29th, 1817, containing the 'Rush-Bagot Convention,' which notes contained an agreement by one and the other party limiting the naval force to be kept on the lakes to a very few: on Lake Ontario one vessel, on the Upper Lakes two vessels, on Lake Champlain one vessel, none of the vessels to exceed one hundred tons burden, and each to have but one cannon of 18 pounds. It was agreed to dismantle forthwith all other armed vessels on the lakes, and that no other vessels of war should be there built or armed; six months' notice to be given by either party of desire of annulling the stipulation.

"The arrangement was after some delay submitted by the President to the Senate, and that body in 1818 approved of and consented to it."

This understanding has continued up to the present time—perhaps not always so strictly observed as might be desired.

"The understanding was, however, in great danger in 1864. The Minister of the United States in London was instructed in October of that year to give the six months' notice required to terminate the agreement; and Mr. Adams did so with the subsequent approval of Congress. Before the lapse of the time specified, however, matters on the lakes had taken a different turn, and the United States expressed a desire that the arrangement should continue and be observed by both parties. This was acceded to and all parties thereafter considered the convention to be in full force."

I say nothing of treaties which have been negotiated and have failed of ratification, or of negotiations which proved fruitless even diplomatically.

ALGONQUIAN INDIAN NAMES OF PLACES IN NORTHERN CANADA.

By J. B. TYRRELL, M.A., F.R.S.C.

(*Read 20th March, 1915.*)

Between the years 1883 and 1898 my work as a Geologist on the Staff of the Geological Survey of Canada made it necessary for me to travel through some of the more remote parts of northern and western Canada, where but few white men, or in some places no white men, had preceded me, and where the geographical features were either very imperfectly known or quite unknown. It was therefore at all times advantageous, and at almost all times absolutely necessary, for me to survey the routes over which I travelled, and to make intelligible maps of these routes, and of as much of the adjoining country as it was possible for me to observe, in order that I might correctly designate on these maps the positions of the various rocks and natural phenomena encountered. In this way these observations were correlated from day to day as the work of exploration proceeded, and a comprehensive view of the mineral resources and geological structure of the region explored was obtained. Such maps also made it possible for others, who might subsequently wish to follow my routes, or to travel on routes in the vicinity of mine, to identify my positions, and to use my observations in connection with their own in the further study of the regions. Finally, they served to inform geologists and mining engineers throughout the world of the exact positions and relationships of the various ores, rocks and geological formations discovered and identified.

In order that the natural features of the countries explored might be intelligently referred to in my Reports, and in those of others who might wish to allude to them later, it was necessary that names should be applied to them, whether such features were mountains, lakes, rivers, or islands.

If white men happened to be living in the districts visited, and if these men had local names for such natural features, these local names were retained whenever they did not conflict with well-known names elsewhere. But much of the country explored was without white inhabitants and the only names immediately available were those used by Indians who lived in the country. Indians were employed by me as

canoemen, etc., on my geological parties, and if these Indians were familiar with the country being explored, many of the names in use among the local tribes were obtained from them. Where such names did not conflict with similar names in use elsewhere, they were generally adopted in my reports and on my maps. When no local or native Indian names were obtainable, I made use of such names of persons or things as seemed appropriate to me at the time.

The names of places recorded in the following pages are those that have been in use from time immemorial by the Indians who live in the immediate vicinity of the places referred to. Some of these names are evidently contractions or corruptions, and their original meanings have been obscured or lost. In most cases, however, the meanings of the names have been determined and are given. In the next column the names in use on the latest Canadian maps are given, after which the approximate positions of the places are designated in terms of North latitude, and longitude West of Greenwich.

These names were collected during the last few years spent by me on the Geological Survey of Canada, mostly in 1896, 1897 and 1898; and afterwards in 1912, when I conducted an expedition through Manitoba to York Factory on Hudson Bay, and thence eastward and southward along the shore of the Bay, up Severn river to its source, down the upper part of the Albany river, and through some of the Upper Waters of the English River to *Sioux Lookout* on the Grand Trunk Pacific Railway.

In my Reports published by the Geological Survey of Canada, on *Northern Alberta* and the *Doobaunt, Kazan* and *Ferguson Rivers* lists of Indian names used in the countries reported on have already been published. In my Reports on Manitoba and adjoining countries, also published by the Geological Survey of Canada, many Indian names were used, and in the maps accompanying those reports the positions of most of those places were given, but no definite Lists of names were published. With the abundance of work which I had to attend to while travelling through Northern Canada, I had neither the opportunity nor the time to become proficient in any of the Indian languages, but I acquired a familiarity with some of the more common words and phrases of the Cree language, since that was the language talked by most of my Indian canoemen. This assisted me in obtaining the correct names of the places visited and here recorded, but nevertheless these names were always confirmed by an interpreter if one was available. While, therefore, these place names have not the merit of having been obtained by a linguist thoroughly familiar with the Algonquian tongue, they have the merit of having been obtained on the spot from Indians or half-breeds

who were intimately acquainted with the country through which we were travelling at the time, and consequently there is no uncertainty as to the natural features to which the names refer.

The names are in the language of the Cree Indians, unless definitely stated to be in Ojibway.

In writing the words here I have given the vowels the continental sounds. On my published maps, however, which were made largely for the use of English-speaking readers, this practice was not adhered to, but the words were spelled in such ways as would seem to suggest the correct pronunciations to English readers. Where Indian names were too long for general use, I occasionally shortened them to about four syllables, retaining, as far as possible, the general character and sound of the words as pronounced by the Indians.

PRONUNCIATION OF THE VOWELS AND DIPHTHONGS.

a as in far.

ā as in all.

ai as in aisle or y in my

e as in met.

ē as a in mate.

i as in pin.

ī as ee in meet.

ŏ as in not.

o as in hotel.

ō as in note, home, &c.

oi as in soil.

u as in nut.

ū as in yule, or oo in loose.

ew as in few.

ow as in now.

IN MANITOBA AND VICINITY.

INDIAN NAME.	MEANING.
1. Aithinetōs'ekwăn Saka'higan	Indian Elbow Lake
2. Aierskit Saka'higan	
3. Akikwun'igūs	Seals' landing-place
4. Akikwun'igūs Sipi'sis	Seals'-landing-place Creek
5. Anakus'ko Si'pi	Broad River
6. Anakus'ko Si'pi Ministik'	Broad River Island
7. Apet' Si'pi	Firesteel river
8. Apitow' gōs'istan' wunigup'	Halfbreed portage
9. Asa'giew Saka'higan	Crayfish lake
10. Askik'ŏ Si'pi	Kettle river
11. Assiniboine Saka'higan	Stoney Indian lake
12. Astik'opisi-sa-wabiko Si'pi	
13. Athapa'puskow Saka'higan	Rock-on-both-sides lake
14. Chacut'inow	A hill
15. Chacut'inow Si'pi	Hill river
16. Echimā'mish Si'pi	Water flowing both ways river
17. G'shē'mat'awā Si'pi	Big-fork river
18. Gūnisē'ū Si'pi	Pike river
19. Gwigwichi wā'chi	Canada Jay's hill
20. Kakekwēkit'chewan	Where the current changes
21. Kāmiskwāp'iskōk	Red rock rapid
22. Kānisō'ta Pow'estik	Two rapids
23. Kapmatas'go-gamag'	Cross lake
24. Ka'-puskit'i-tū'e musin	Over-the-hill rapid

IN MANITOBA AND VICINITY.

PRESENT NAME.	LAT.	LONG.	REMARKS.
1. Elbow Lake	54° 50′	100° 50′	Ithenootosequan (David Thompson)
2. Footprint Lake	55° 48′	99° 00′	
3. Seal Island	56° 55′	92° 40′	
4. Seal Creek	56° 55′	93° 00′	
5. Broad River	57° 10′	90° 33′	
6.	57° 10′	90° 30′	
7. Hayes River, between the mouths of Hill and Shamatta rivers			Apit sibi (Jeremie)
8. Borwicks portage	55° 37′	93° 25′	
9. Asagiew Lake	56° 41′	95° 17′	
10. Kettle River	56° 55′	89° 30′	
11.	52° 25′	96° 45′	On tributary of Berens River
12. Stony River	57° 35′	92° 40′	
13. Athapapuskow Lake	54° 35′	101° 35′	
14. "The Hill," or Brassy Hill	55° 30′	93° 35′	Chuckitanow (Cocking)
15. Hayes River, between Swampy Lake and Fox River			
16. Echimamish River	54° 20′	97° 20′	
17. Shamattawa River	56° 23′	93° 00′	Guiche' Mataouang (Jeremie)
18. Gunisao River	53° 35′	97° 00′	
19. Whiskey-jack Portage	54° 28′	97° 55′	
20. Ebb and Flow	51′	99°	
21. Red Rock Rapid	54° 50′	98°	
22. Kanisota Rapids	54° 55′	99° 20′	
23. Cross Lake	53° 30′	96°	Ojibway
24. Hill Rapid	54° 49′	98°	

IN MANITOBA AND VICINITY.

INDIAN NAME.	MEANING.
25. Kasap'isko Pow'estik	Sharp rock rapids
26. Kasipa'chewuk Pow'estik	
27. Kas'katama'gan Sipi	
28. Katimistig'wiak Sipi	Broad river
29. Kawāsi'chewan	Glittering Water (Rapid on Muskuskow River)
30. Kias'ko Saka'higan	Gull lake
31. Kikakwakwē'panik	Water surging up and flowing out in all directions
32. Kinē'pikiniwewe Sipisis	Long body creek
33. Kinē'wi Pow'estik	Golden-eagle rapid
34. Kisē mit'iskun Sipi	Old fish-dam river
35. Kis'kwepēw Saka'higan	Drunken lake
36. Kiskitŏg'isiwi Saka'higan	Cut-gut lake
37. Kowtunā'gan Saka'higan	Perch-dish lake
38. Kistimun' Saka'higan	File lake
39. Kisiskat'chewa'na Sipi	Swift current river
40. Manitō'bā' Saka'higan	Manito (or spirit) narrows lake
41. Mā'chichi Sipi	Last river
42. Makē'se Sipi	Fox river
43. Makāk'ut Ministik	
44. Mā-namē'go-nawat'chiwi	Toasting-catfish-on-a-stick
45. Man'asan Sipi	Shell river
46. Man'asan Pow'estik	Shell falls
47. Manigotā'gan Sipi	Bad-throat river
48. Manichōn'igūs	Manito (or spirit or imp) landing place
49. Manito Wŭnigup	Manito portage
50. Mantago Sipi	
51. Manum'inan Saka'higan	Red paint lake
52. Maskūsi Ministik	Hay island
53. Maskis'tigwan Sakahigan	Knee lake
54. Minā'kwinan' Sipis	Cleaning-roe-out-of-fish creek
55. Minē'go Sipi	Spruce river

IN MANITOBA AND VICINITY.

PRESENT NAME.	LAT.	LONG.	REMARKS.
25. Sharp Rock Rapids	54° 52′	95° 17′	
26. Kisipatchewuck Rapid	54° 17′	98° 20′	
27. Kaskatamagan River	57° 00′	90° 10′	
28. Broad River	58° 10′	92° 50′	
29. Kwasitchewan Fall	55° 15′	98° 20′	
30. Gull Lake	56° 18′	95° 25′	
31. Ebb and Flow Rapid, Nelson River	54° 43′	97° 50′	
32. Longbody Creek	51° 45′	96° 40′	
33. Kinawi Rapid	51° 34′	96° 20′	
34. Kisemitiskun River	56° 40′	94° 00′	
35. Drunken Lake	54° 30′	98° 25′	
36. Kiskittogisu Lake	54° 15′	98° 20′	
37. Kowtunigan Lake	51° 32′	95° 55′	
38. File Lake	54° 55′	100° 20′	
39. Saskatchewan River			Quisisquatchiouen (Jeremie)
40. Manitoba Lake			
41. Machichi or Fourteen River	57°	92° 15′	
42. Fox River	56°	93° 30′	
43.	57° 15′	91° 15′	Island in Hudson Bay
44. Catfish Creek	53° 55′	98° 10′	
45. Manasan River	55° 40′	98° 00′	
46. Manasan Falls	55° 43′	97° 57′	
47. Badthroat River	51° 6′	96° 20′	
48. Wetigo Island in Wuskwatim Lake	53° 34′	98° 37′	
49. Manitou Portage	54° 45′	98° 6′	
50. Mantagao River	51° 45′	97° 50′	
51. Paint Lake	55° 28′	98° 00′	
52. Hay Island	57°	92° 25′	
53. Knee Lake	55°	95°	
54.	52° 11′	96° 54′	
55. Minago Creek	51° 36′	96° 20′	

IN MANITOBA AND VICINITY.

INDIAN NAME.	MEANING.
56. Minē'go Sipi	Spruce river
57. Mistigokān' Sipi	Beacon river
58. Misipisew Ōtup'ewin	Lyon's den
59. Miskowow' Sipi	Blood river
60. Mijisk' Saka'higan	Rump lake
61. Mitichto Pow'estik	Limestone rapid
62. Mitichto Sipi	Limestone river
63. Minis'tigo Minē'gosow	Spruce-plentiful island
64. Muhigun' Sipi	Wolf river
65. Muskē'go Wunigup	Swampy portage
66. Mus'koaska'higan Sipisis	Black-bear-house creek
67. Muskūskow' Sipi	Grassy river
68. Mūsogotē'wi Saka'higan	Moose nose lake
69. Minitonas'	Isolated hill
70. Namē'ko Saka'higan	Trout lake
71. Namēgo'se Pow'estik	Trout falls
72. Namēgo'se Sipi	Trout river
73. Nēowinan'	Four points
74. Natawē'winan'	Egg-hunting place
75. Nestawē'ya	Three points
76. Nipow'in!	The place where people stand
77. Nikik'wanō'kūs	Otter landing place
78. Niski Saka'higan	Goose lake
79. Nistowean' Saka'higan	Three-points lake
80. Nisotaniga	The two portages
81. Niskwapē'o Sipisis	Drunken creek
82. Niskitŏgisēwi Sipi	Goose-gut river
83. Nōtin' Saka'higan	Wind lake
84. Nōchiwawani Sipisis	Wavy-hunting creek
85. Nŏtawatow'i Sipi	Fetching river
86. Nōtaminaganan' Sipi	Hunting-suckers river
87. Nōtawēwinan Saka'higan	Egg-gathering lake

IN MANITOBA AND VICINITY.

PRESENT NAME.	LAT.	LONG.	REMARKS.
56. Minago River	54° 15′	99° 00′	
57. Ship or Mistagokan River	57° 7′	91° 45′	
58. Misipisew River	55° 00′	99° 27′	
59. Miskowow River	51° 47′	96° 45′	
60.			
61. Limestone Rapid	56°	92° 30′	
62. Limestone River	56° 30′	94° 15′	
63. Cumberland Island or Pine Island	53° 55′	102° 15′	In Province of Saskatchewan
64. Muhigan River	54° 40′	98° 30′	
65. Mossy Portage	55° 13′	94° 10′	
66. Bear Creek	57° 6′	92° 45′	
67. Grass River	54° 45′	97°-101°	
68. Moose-nose Lake	56° 28′	95° 20′	
69. Minitonas Hill	52° 00′	101° 05′	
70. Namako Lake	56° 52′	94° 58′	
71. Trout Falls	54° 52′	95° 15′	
72. Salmon River	58° 15′	93°	
73. In Little Playgreen Lake	54° 2′	97° 50′	
74. Egg Lake	55° 45′	97°	
75. Mouth of Assiniboine River	49° 53′	97° 7′	Site of Winnipeg City
76. Nipowin Rapids	53° 30′	104°	In the Province of Saskatchewan
77. Otter Island	54° 35′	97° 45′	In Cross Lake
78. Niski Lake	56° 57′	94° 45′	
79. Three Point Lake	55° 42′	99° 00′	
80.	55° 26′	93° 42′	
81. Four-mile Gully	56° 57′	92° 32′	
82.			
83. Windy Lake	54° 40′	96°	
84. Sam's Creek	57° 12′	92° 40′	
85. French Creek	56° 57′	92° 30′	
86. Sucker River	55° 18′	97° 47′	
87. Great Playgreen Lake	54°	98° 15′	

IN MANITOBA AND VICINITY.

INDIAN NAME.	MEANING.
88. Ohō *S*ipi	Owl river
89. Omach*i*'wi Saka'higan	
90. Opē'ganō Saka'higan	Bones-of-the-pelvis lake
91. Opā'	A narrow place
92. Opas'kwēow'	Narrows between high banks
93. Opimine'goka' Saka'higan	Narrow spruce lake
94. Opipūnup'uwi Saka'higan	Wintering lake
95. Opipūnup'uwin Ministik	Wintering island
96. Opunikap' *p*ipishis'tagim'uwan	Smooth rock portage
97. Ospwa'gana Saka'higan	Pipe (or pipestone) lake
98. Oskatas'kwe *S*ipi	Carrott river
99. Ota'wea'wikow *S*ipi	Heart river
100. Otō'sa *S*ipi	Milk river
101. Otuk'aw*i*'towin	Where the water does not freeze
102. Owun'ikwa'nao Sip*i*sis	Woodpecker (Cock of the woods) creek
103. Pakowē'mistikūsha Ministik	Frenchman's island
104. Pakwe'higan Saka'higan	Chip lake
105. Pā Nipā'wa N*i*pi	A hole through the earth
106. Paskōskā'gan Saka'higan	Treeless island lake
107. P*i*'pikwanus'ko Saka'higan	Reed lake
108. P*i*chipunā'gansis	A barrier
109. Pimichicomow Saka'higan	Cross lake
110. Pimichin'iga	Cross portage
111. P*i*sew Pukwa'gan Saka'higan	Lynx-fishing lake
112. P*i*sew Pow'estik	Lynx rapid
113. Pow'*i*nigow *S*ipi	
114. Pukitowa'gan Saka'higan	Fishing-with-a-net lake
115. Pukuchin'imē'o *S*ipi	Sturgeon river
116. Pūnagutwē'o *S*ipi	Light-the-fire river
117. Sagas'kwaskow *i*'niga	Thicket portage
118. Sagich'tigow Sip*i*sis	
119. Sakitow'a Pow'estik	Head of river, just below lake, rapid
120. Sasagin'igak Saka'higan	Island lake

IN MANITOBA AND VICINITY.

PRESENT NAME.	LAT.	LONG.	REMARKS.
88. Owl River	57° 58′	92° 50′	
89. On Bloodvein River			
90. Opegano Lake	55° 35′	98° 20′	
91. The Pas	53° 48′	101° 15′	
92. The Pas	53° 48′	101° 15′	
93. Pine Lake	54° 35′	96° 05′	
94. Wintering Lake	55° 25′	97° 45′	
95.	55° 24′	97° 45′	
96. Smooth Rock Portage	55° 24′	93° 43′	
97. Pipe Lake	55° 35′	98° 05′	
98.	53° 45′	102° 00′	
99. Heart Creek	57° 1′	92° 48′	
100. Milk River	56° 52′	89° 05′	
101. Big Bend, N. Sask. River	54° 00′	101° 30′	
102. Woodcock Creek	57° 5′	92° 45′	
103. Rainbow Island	56° 54′	92° 45′	
104. Pakwahigan Lake	54° 55′	98° 55′	
105. Oxford Lake	54° 50′	95° 45′	
106. Playgreen Lake	54°	98° 15′	
107. Reed Lake	54° 37′	100° 25′	
108. The Barrier	53° 52′	101° 50′	
109. Cross Lake	54° 45′	97°-98°	
110. Cross Portage	55° 13′	97° 18′	
111. Cat Fishing Lake	56° 35′	95° 25′	
112. Pisew Rapids	55° 12′	98° 25′	Paouiriniouagaou (Jeremie)
113. Nelson River	54°-57°	93°-98°	Powethiniko (Cocking)
114. Setting Lake	55° 00′	98° 30′	
115. Sturgeon Creek	51° 35′	95° 55′	
116. Pennycutaway River	56° 43′	92° 50′	
117. Thicket Portage	55° 18′	97° 42′	
118.	54° 52′	99° 15′	
119.	51° 47′	96° 45′	
120. Sasaginnigak Lake	51° 35′	95° 45′	

IN MANITOBA AND VICINITY.

INDIAN NAME.	MEANING.
121. Sasagin'igak *Si*pi	Island river
122. Sasagin'igak Mat'awa	Island forks
123. *Si*'pastik	Channel
124. *Si*pastik *Si*pi	Channel river
125. *Si*pi*w*isk Saka'higan	Light-through-the-trees lake
126. Sika'go Pow'estik	Skunk rapid
127. Sis*i*b' Saka'higan	Duck lake
128. Sis*i*b' Wunigup	Duck portage
129. Sis*i*b' Pow'estik	Duck rapid
130. Sutē' *Si*pi	Turtle river
131. Suskiskwē'gimew Saka'higan	Where-the-sturgeons-put-their-heads-against-the-rock lake
132. Tatas'kwēo Saka'higan	Split lake
133. Taskinigup	Split (rock) portage
134. Ta'tūskituanūs	Tearing (or rending) river
135. Unun-takamē'iwin	Island narrows
136. Untawab'uwin Wunigup	Seeing portage
137. Uspwa'gan Saka'higan	Pipestone lake
138. Wabinē'o Sip*i*sis	White partridge creek
139. Wach*i*'wi Saka'higan	Hill lake
140. Wachicha Cop'asēw	Crane's breast
141. Wagana'gansow *Si*pi	Tamarac-abundant river
142. Wakath'tigow' Pow'estik	Jackpine rapid
143. Wakath'tigow Wunigup	Jackpine portage
144. Wan'ipagow' *Si*pi	Hole river
145. Wapāk'wachew Pow'estik	White frost rapid
146. Wapaskath'kagow	Jackpine narrows
147. Wapasko Sip*i*sis	White bear creek
148. Wapik'opow' Saka'higan	Willow-point lake

IN MANITOBA AND VICINITY.

PRESENT NAME.	LAT.	LONG.	REMARKS.
121.	51° 35′	95° 50′	
122.	51° 33′	96°	
123.	53° 57′	98° 3′	
124. Ten Shilling Creek	56° 57′	92° 29′	
125. Sepiwisk Lake	55°	97° 30′	
126.	54° 50′	99° 06′	
127. Duck Lake	54° 50′	98° 10′	
128. Duck Lake Portage	54° 48′	98° 15′	
129. Duck Rapids	54° 40′	96° 00′	
130. Turtle River	51° 30′	96° 07′	Susquagemow (Thompson)
131. Landing Lake	55° 15′	97° 15′	Anisquaouigamou (Jeremie)
132. Split Lake	56° 00′	96° 30′	Tatusquoyaou secahigan (Jeremie)
133. Taskinigup Portage	55° 32′	98° 31′	
134. Tearing River	53° 53′	102° 00′	
135.	52° 00′	95° 30′	
136. Seeing Portage	55° 24′	93° 45′	
137. Pipestone Lake	54° 30′	97° 35′	
138. Partridge Creek	57° 28′	92° 40′	
139. Hill Lake	54° 30′	98° 25′	
140.	56° 3′	93° 20′	Cliff at junction of Fox and Hill Rivers
141.	56° 45′	92° 10′	
142. Jackpine Rapid	54° 30′	96° 15′	
143.	55° 30′	98° 5′	
144. Wannipagow River	51° 10′	96° 15′	
145.	54° 50′	99° 10′	
146.	54° 42′	97° 30′	
147. White Bear Creek	57° 26′	92° 40′	
148. Wapikopow Lake	56° 46′	95° 10′	

IN MANITOBA AND VICINITY.

INDIAN NAME.	MEANING.
149. Wapik'amow Saka'higan	Narrows-with-a-current lake
150. Wapich'tagow Sipisis	Thicket creek
151. Wapich'tagow Pow'estik	Thicket falls
152. Wa'pinihik'iskow Saka'higan	White spruce lake
153. Wa'pisew Saka'higan	Swan lake
154. Wa'pisew Saka'higansis	Swan little-lake
155. Wapitunusk' Pow'estik	White mud rapids
156. Wasē'gamow Saka'higan	Clearwater lake
157. Waska'higan Sipisis	House creek
158. Waskataska Sipisis	Carrot creek
159. Waskiktē'pigo Saka'higan	Waterlily lake
160. Wa'wakiskit'chewan	Surging water (ebb and flow)
161. Wech'tigo Iskwastim'	Devils gate
162. We'tigo Untahipitchegan	Devil's handing place
163. Wikusko Saka'higan	Sweet-grass (or herb) lake
164. Wikusko Pow'estik	Sweet-grass (or herb) rapids
165. Wipatinow Saka'higan	Valley lake
166. Winis'ko Saka'higan	Woodchuck lake
167. Winipēg'	Nasty water
168. Winipēg' Saka'higan	Nasty-water lake or Sea or Ocean lake
169. Winipēg'o Pow'estik	Sea falls
170. Winipeg'osis' Saka'higan	Little-Winnipeg lake
171. Wipiskow' Sipi	Burntwood River
172. Wipān'ipā'nis Wunigum	Angling portage
173. Wuska'tigai' Pow'estik	Jackpine rapid
174. Wuskwatim' Saka'higan	Beaver-dam lake
175. Wuskwatim' Pow'estik	Beaver-dam rapids

IN MANITOBA AND VICINITY.

PRESENT NAME.	LAT.	LONG.	REMARKS.
149. Wapikamow Lake	56° 10′	91° 30′	
150. Wapichtigow River	55° 35′	98° 10′	
151. Wapichtigow Falls	54° 50′	99° 3′	
152. Wapinihikiskow Lake	56° 55′	94° 50′	
153. Swan Lake	56° 48′	95° 00′	
154. Little Swan Lake	56° 50′	95° 00′	
155. White Mud Falls	54° 43′	97° 55′	
156. Wasagamow Lake	56° 43′	95° 15′	
157. Duck Creek	57° 20′	92° 40′	
158. Waskataska Brook	55° 00′	99° 30′	
159. Waskik Lake	54° 30′	98° 45′	
160.	54° 45′	97° 15′	Wethaweewakechewan (Cocking)
161. Hell Gate	54° 32′	96° 10′	
162. Devil's Handing Place	55° 22′	93° 50′	
163. Wekusko Lake	54° 45′	99° 45′	
164. Wekusko Falls	54° 48′	99° 54′	
165. Wepatinow Lake	56° 10′	91° 20′	
166. Hairy Lake	54° 20′	97° 20′	
167. Hudson Bay or The Ocean			
168. Lake Winnipeg			
169. Sea Falls	54° 14′	97° 37′	
170. Molson Lake	54° 18′	96° 45′	
171. Burntwood River	55° 30′	97°-100°	
172. Wepunipanis	54° 43′	96°	
173.	55° 36′	98° 16′	
174. Wuskwatim Lake	55° 35′	98° 35′	Ooskootim (Thompson)
175. Wuskwatim Fall	55° 32′	98° 34′	

IN NORTH-WESTERN ONTARIO.

INDIAN NAME.	MEANING.
176. Amisko *S*ipi	Beaver river
177. Kokū'si Ministik	Pig island
178. Mintiē'gan *S*ipi	Courtezan river
179. Mistiministik	Big island
180. Nagow' Assini	Sand rock (on Fawn river)
181. Namāco *S*ipi	Trout river
182. Namāco Saka'higan	Trout lake
183. Nisk*i*'bi *S*ipi	Goose river
184. Nisk*i*'bi Saka'higan	Goose lake
185. Saskago' *S*ipi	Cache river
186. Tomun'isitē'o *S*ipi	Foot river
187. Washaho' *S*ipi	Bay river
188. Washaho Saka'higan	Bay lake
189. Agigamo' Sip*i*s	Squirrel creek
190. Agut'ua' Saka'higan	Hill lake
191. Chē'g*i*shika Saka'higan	Big-cedar lake
192. Chē' Pow'estik	Big rapid
193. Chē'wunegum	Big portage
194. Chicā'go Saka'higan	Skunk lake
195. Gechē'assin Saka'higan	Big stone lake
196. G*i*'shika Saka'higan	Cedar lake
197. Kabadan'egum	Unloading portage
198. Ka gechē'atik'ameg kag	Big-whitefish lake
199. Kak*i*weap'ekemung	Rocky portage
200. Ka'kewa san'digimung'	Brushy portage
201. Kakwâi'ukōgamag	Straight lake
202. Ka'nikim'inika Sip*i*s	Geeseberry (*Vac. uliginosum*) creek
203. Kawapasin'iskak	White stone lake
204. Kawa'gami	Clear lake
205. Keg'wunigum	Porcupine portage
206. Makūp'*i* Saka'higan	Bear lake
207. Makūp'*i* Wunigum	Bear portage
208. Mijik'en Pow'estik	Fence (barrier) rapid
209. Mūs'wachi	Moose hill
210. Mukwane'gan Sip*i*s	Bear trap creek
211. Nagow'unga	Sandy point

IN NORTH-WESTERN ONTARIO.

PRESENT NAME.	LAT.	LONG.	REMARKS.
176. Amisko River	55° 57′	88° 00′	Cree
177. The Pens	56° 50′	89° 00′	"
178. Mintiagan River	56° 47′	88° 25′	"
179. Head Island	56° 45′	88° 45′	"
180.	54° 30′	88° 20′	"
181. Fawn River	55°	88°	"
182. Trout Lake			
183. Niskibi or Goose River	56° 30′	88° 10′	"
184. Niskibi Lake	56°	90°	"
185. Saskago River	55° 5′	89° 30′	"
186. Tomuna River	56° 32′	88° 20′	"
187. Severn River	56° 00′	87° 35′	"
188. Severn Lake	53° 50′	91°	"
189. Agigima Creek	53° 12′	91° 7′	Ojibway
190. Agutua Lake	52° 40′	91° 28′	"
191. Shegeeshika Lake	52° 7′	92° 7′	"
192. Big Rapid	52° 28′	91° 55′	"
193. Shewunegum Portage	52° 38′	91° 30′	"
194. Chicago Lake	53° 4′	91° 22′	"
195. Gicheassin Lake	53° 5′	91° 15′	"
196. Geeshika Lake	52° 20′	92° 15′	"
197. Kabadanegum Portage	53° 00′	91° 27′	"
198. Shetickameg Lake	53° 01′	91° 25′	"
199. Apekamung Portage	53° 07′	91° 07′	"
200. Brushy Portage	53° 13′	91° 04′	"
201. Kwiuswagami Lake	53° 28′	90° 55′	"
202. Nikiminika Creek	53° 14′	91° 05′	"
203. Wapasini Lake	51° 57′	92° 03′	"
204. Kawagami Lake	53° 27′	90° 40′	"
205.	52° 15′	92° 15′	"
206. Makoop Lake	53° 24′	91°	"
207. Makoop Portage	53° 19′	91°	"
208. Mijiken Rapid	53° 10′	91° 05′	"
209. Moose Mountain	52° 20′	92° 20′	"
210.	53° 15′	91° 05′	"
211. Nagowunga	52° 58′	91° 26′	"

IN NORTH-WESTERN ONTARIO.

INDIAN NAME.	MEANING.
212. Nemē'bina Saka'higan	Sucker lake
213. N*i*gig'amog Sip*i*s	Otter teat creek
214. Ningitow'a Saka'higan	Forks lake
215. Ningitow'a S*i*pi	Fork river
216. Ō̄buskan'digan	Little jackpine narrows
217. Ō̄jiji Pow'estik	Outlet-of-lake rapid
218. Okad'ua Saka'higan	Leg lake
219. Okik ka wid'gewung	Jackpine portage
220. Op*i*chigokow' Saka'higan	Wooded narrow lake
221. Pijik'i Wigwa'akwun Sip*i*s	Cow's chin creek
222. P*i*sew Powestik	Lynx falls
223. Saskat'chewa'wa	
224. Wabaw'unga	Narrow sandy point
225. Wabigo' ko'ko Saka'higan	White owl lake
226. Wagūs' Powestik	Fox rapid
227. Wanunk M*i*nistik	Star island
228. Wask*i*'sigo Saka'higan	Eye lake
229. Wāweā'gamow Saka'higan	Round lake
230. Win'digo Saka'higan	Imp lake

IN NORTH-WESTERN ONTARIO.

PRESENT NAME.	LAT.	LONG.	REMARKS.
212. Nemebina Lake	52° 00′	92° 10′	Ojibway
213. Negigamog Creek	53° 21′	91°	"
214. Ningitowa Lake	53° 11′	92° 02′	"
215. Ningitowa River	53° 19′	91° 05′	"
216.	53° 09′	90° 04′	"
217. Ojiji Rapid	53° 13′	91° 05′	"
218. Okadua Lake	52° 26′	92° 00′	"
219. Okik Portage	53° 08′	91° 05′	"
220. Lac Seul	50° 20′	92° 30′	"
221. Pijiki Creek	53° 13′	91° 07′	"
222. Pisew Falls	51° 51′	92° 00′	"
223. Saskatchewawa River	52° 45′	91° 30′	"
224. Wabawunga Point	53° 24′	91°	"
225. Wabigokoko Lake	53° 06′	91° 10′	"
226. Wagoos Rapid	53° 16′	91° 05′	"
227. Wanunk Island	53° 13′	91° 03′	"
228. Waskisigo Lake	53° 05′	91° 20′	"
229. Weagamow Lake	52° 55′	91° 30′	"
230. Windigo Lake	52° 30′	91° 40′	"